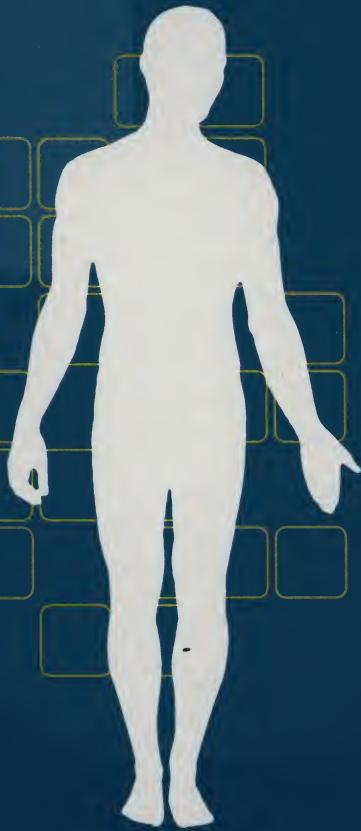




The systems, organs, structures, and common diseases of the human body, including:

THE ILLUSTRATED PORTFOLIO OF HUMAN ANATOMY AND PATHOLOGY



Gastrointestinal
Respiratory
Cardiovascular
Nervous
Muscular
Skeletal
Male Reproductive
Female Reproductive

Please refer to page 9 for important safety and other information.

Compliments of

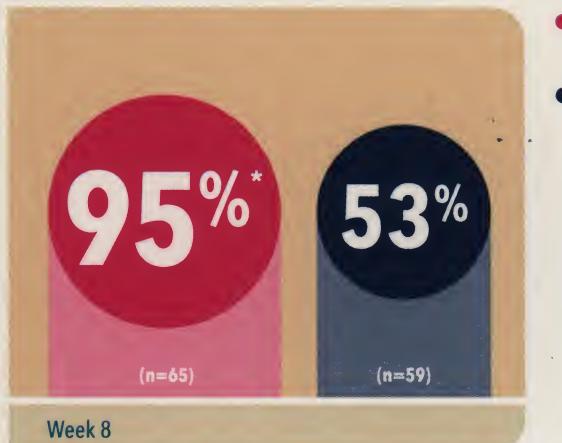




"Will this PPI heal my EE?"

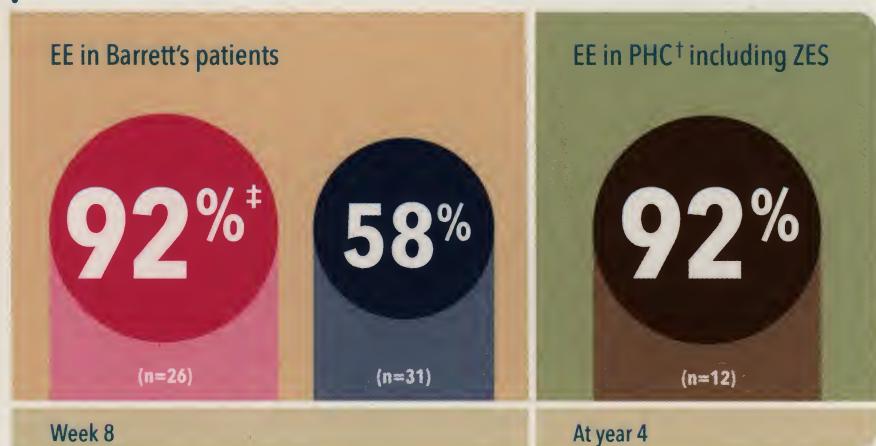
PREVACID is committed to healing severe to mild Erosive Esophagitis (EE)

Up to 95% of patients with EE were healed by week 8 with PREVACID 30 mg QD^{1,3}



*p<0.001 vs placebo.

PREVACID effectively healed EE in up to 92% of Barrett's esophagus patients by week 8 and in patients with ZES[†] at year 4³



[†]Pathological hypersecretory conditions (PHC) including Zollinger-Ellison Syndrome (ZES) in an open-label study.

[‡]p<0.01 vs active control.

Additional efficacy information

- 92% of patients with EE were healed by week 8 with PREVACID 30 mg QD vs 70% with active control (n=114, n=123, respectively; p≤0.001)^{1,3,4}
- 94% of Barrett's esophagus patients were healed from EE with PREVACID 30 mg QD at week 8 vs 35% with active control in a retrospective analysis of a subset of patients from two other studies (n=17, n=17, respectively; p<0.01)³
- Please refer to page 9 for important safety information including adverse events
- PREVACID is not indicated for the treatment of Barrett's esophagus
- PREVACID is indicated for the long-term treatment of pathological hypersecretory conditions, including ZES



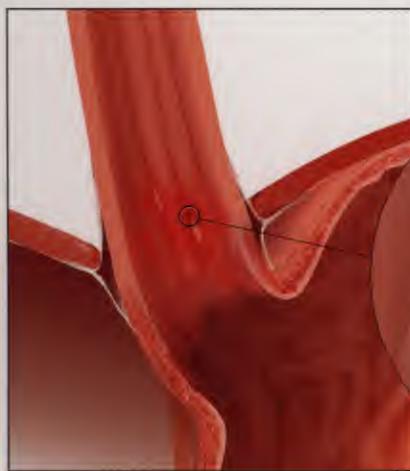
PREVACID[®]

LANSOPRAZOLE

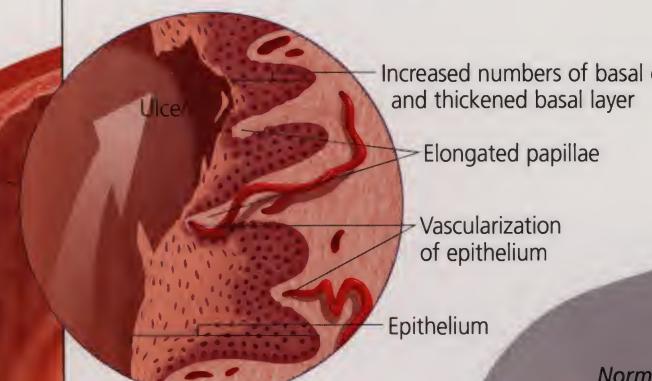
Uniquely patient driven.



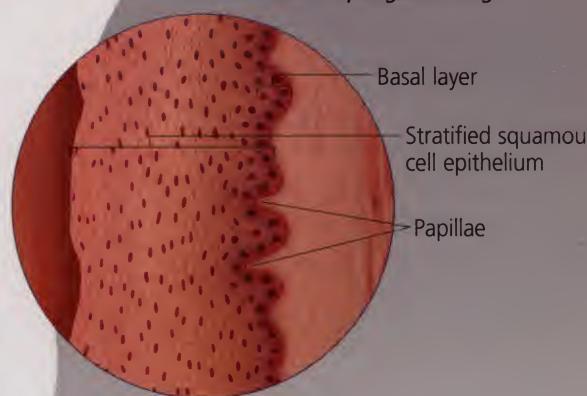
Erosive Esophagitis



Esophageal Lining with Esophagitis



Normal Esophageal Lining



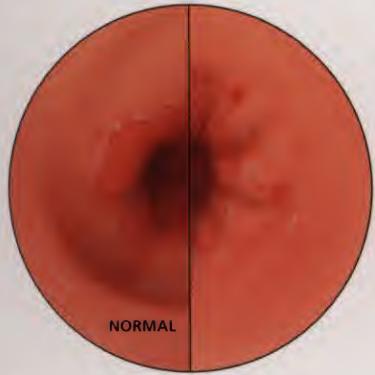
What is Esophagitis?

When heartburn becomes more frequent, there is a chance of esophagitis, an irritation (inflammation) of the esophageal lining caused by stomach acid. If the esophagitis becomes severe, the result can be bleeding and difficulty in swallowing because of a constriction (stricture) of the esophagus. Some people with severe esophagitis develop Barrett's esophagus.

What is Erosive Esophagitis?

GERD (gastroesophageal reflux disease) or heartburn is a frequent discomfort. About 1 in 10 adults has heartburn at least once a week; 1 in 3 has the problem at least once a month. Symptoms include a burning sensation in the chest that may start in the upper abdomen and radiate into the neck. Sour or bitter-tasting material is regurgitated into the throat and mouth, especially when lying down or sleeping. Continual chest discomfort after swallowing hard or liquid foods, inflammation of the esophagus, weight loss and vomiting of blood are symptoms of other problems often associated with GERD. Usually a description of symptoms will allow a physician to establish the diagnosis of heartburn.

Endoscopic Views

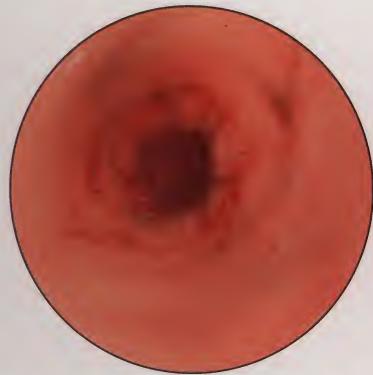


NORMAL



Grade I

- One or more red-colored lesions present in the esophagus
- May or may not produce fluid as a result of inflammation
- Lesions are separate, not joined together



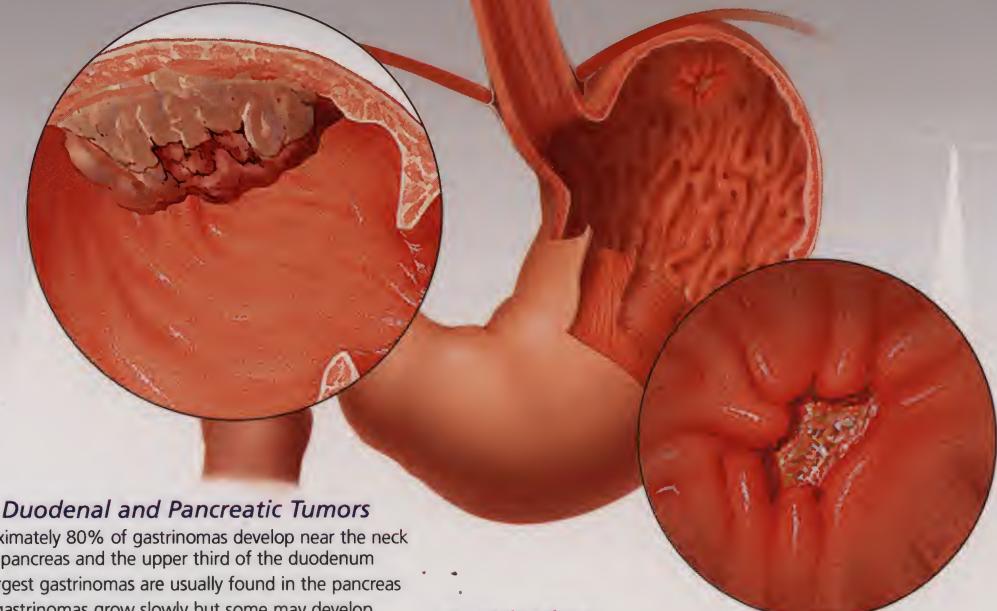
Grade II

- Lesions are erosive and exude fluid
- Present in the distal end of the esophagus
- May be merged together to form a mass

Grade III

- Erosions seen around the circumference of the distal esophagus
- Hemorrhaging and exudation from membranes present

- Involves chronic complications such as deep ulcers
- Stricture or narrowing of the esophagus may be present
- Mucosa may be scarred or exhibit signs of Barrett's metaplasia



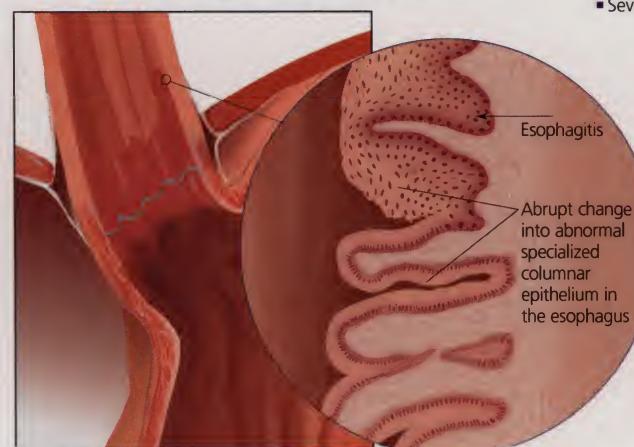
ZES – Duodenal and Pancreatic Tumors

- Approximately 80% of gastrinomas develop near the neck of the pancreas and the upper third of the duodenum
- The largest gastrinomas are usually found in the pancreas
- Most gastrinomas grow slowly but some may develop more quickly and spread to surrounding sites
- Tumors caused by ZES are usually diagnosed by blood tests to measure the body's levels of acid-producing gastrin

Gastric Ulcers

- Areas in the protective lining of the gastrointestinal mucosa that have been injured by stomach acids and digestive enzymes
- May range in size from a few millimeters to several centimeters
- Often caused by the bacteria *H. pylori* or use of non-steroidal anti-inflammatory medications (NSAIDs)
- Primary symptoms involve chronic gnawing or burning abdominal pain
- Severe, multiple ulcers may be associated with ZES

Esophageal Lining with Barrett's Epithelium



For further information, please see the accompanying complete prescribing information.



Uniquely patient driven.

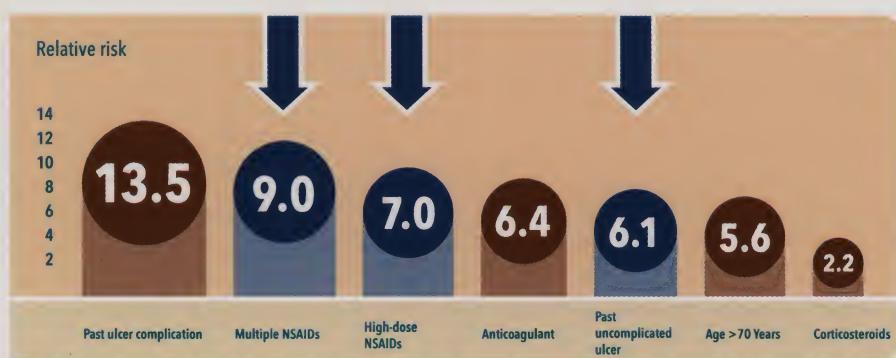


Risk Factors, Signs, and Symptoms

Possible risk factors for NSAID*-related ulcer complications⁵

- History of ulcer or GI complication
- Increased age (≥ 65 years old)⁶
- Multiple NSAID use
 - Use of multiple NSAIDs, such as aspirin with an NSAID, increases the risk of upper GI complications⁷
- Concomitant use of oral corticosteroid or anticoagulants

Past history of ulcer or use of multiple NSAIDs or high-dose NSAIDs can increase the risk of upper GI complications⁸



Based on a UK, retrospective analysis of 1,457 upper GI complication cases and 10,000 control subjects. Relative risk analysis for high-dose NSAIDs was based on 862 upper GI complication cases and 9,017 control subjects. Adapted from Garcia Rodriguez et al. *Lancet*. 1994.⁸

*Nonsteroidal anti-inflammatory drug.

Important Safety Information

- The most frequently reported adverse events with PREVACID were diarrhea (3.8%), abdominal pain (2.1%), and nausea (1.3%). In the risk reduction study of PREVACID for NSAID-associated ulcers, the incidence of diarrhea was 5% and 3% for the PREVACID and placebo groups, respectively.
- Symptomatic response to therapy does not preclude the presence of gastric malignancy. PREVACID is contraindicated in patients with known hypersensitivity to any component of the formulation.
- Please see the accompanying complete prescribing information for PREVACID.

Possible signs and symptoms of acid reflux disease (GERD)⁹

- Heartburn
- A sour taste in the mouth
- Regurgitation
- Difficulty swallowing
- Persistent coughing
- Hoarseness
- Chest pain, not related to the heart

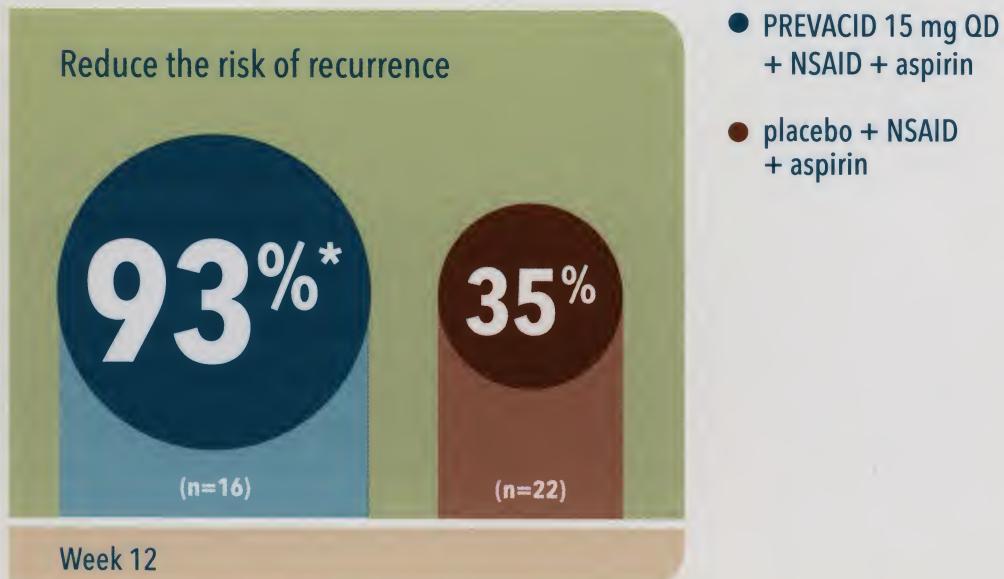
- PREVACID heals gastric ulcers associated with NSAIDs and helps to protect against recurrence in patients who continue NSAID use
 - Controlled studies were conducted up to 8 weeks and 12 weeks, respectively
- PREVACID also treats (for up to 8 weeks) gastroesophageal reflux disease including erosive esophagitis (most erosions heal in 4 to 8 weeks)



"Can I reduce the risk of having another NSAID GU?"

Add PREVACID to any NSAID for increased gastric protection in patients who have a history of gastric ulcer (GU)

- In patients with a history of GU, PREVACID significantly reduced the risk of GU recurrence in a study of 535 chronic NSAID users. 80% of PREVACID 15 mg QD patients remained GU free at week 12 while continuing to take an NSAID (n=121)¹
- In a subset analysis of 70 patients taking an NSAID with chronic low-dose aspirin, significantly more patients taking PREVACID 15 mg QD were GU free at week 12³



*p≤0.001.

- This was a prospective, double-blind, multicenter, active- and placebo-controlled study of 535 long-term NSAID users with a history of endoscopically documented GU. Patients were randomized to receive placebo, 200 µg of misoprostol QID, or 15 mg or 30 mg of lansoprazole QD for 12 weeks. Eligible patients had been taking daily doses of an NSAID and continued NSAID use as prescribed through the completion of the 12-week study. Percent of patients remaining GU free at week 12 was 51% for placebo (n=112), 80% for PREVACID 15 mg (n=121), 82% for PREVACID 30 mg (n=116), and 93% for misoprostol (n=106)^{1,10}

- In the chart above, results shown are from a retrospective, subset analysis of 70 patients taking PREVACID 15 mg QD, an NSAID, and chronic low-dose aspirin (≤325 mg/day). Percent of patients remaining GU free at 12 weeks with placebo was 35% (n=22), with PREVACID 15 mg QD was 93% (n=16), with PREVACID 30 mg QD was 100% (n=7), and with misoprostol 200 µg QID was 96% (n=25)³
- No significant difference in efficacy was seen between PREVACID 15 mg (indicated dose) and 30 mg

- Please refer to page 9 for important safety information including adverse events

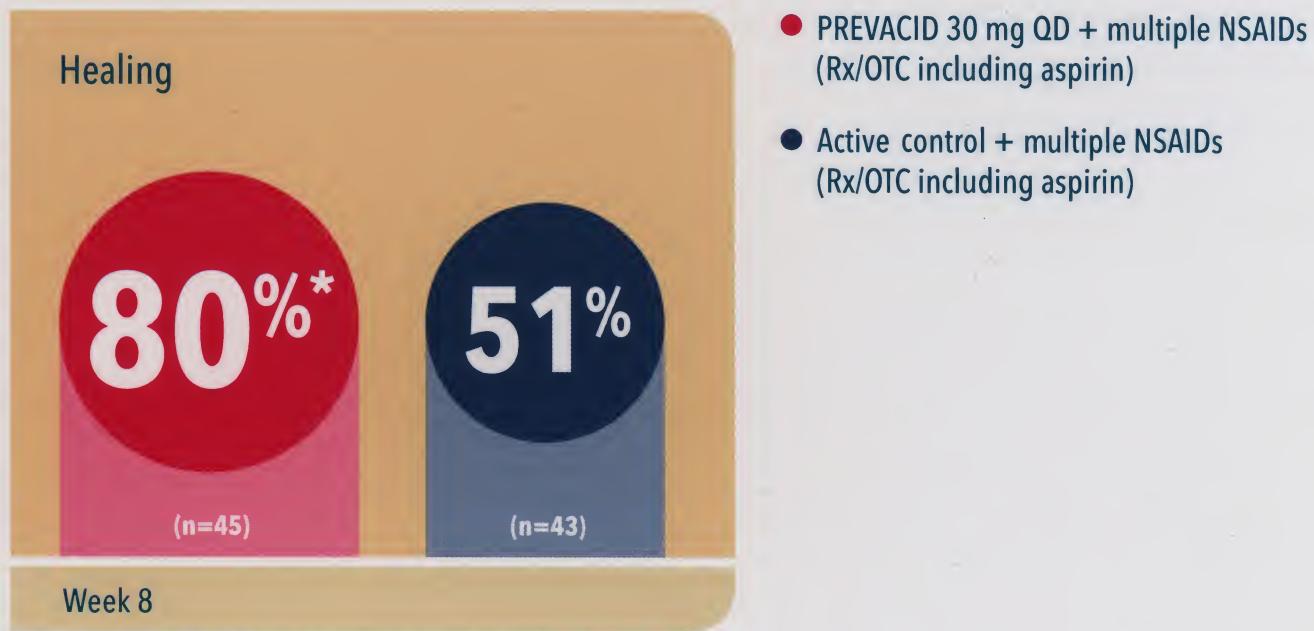


"Will my gastric ulcer heal if I continue my NSAID use?"

Address the need for healing and reduce the risk of recurrence

PREVACID 30 mg QD significantly healed 79% and 77% of patients by week 8 where study protocol required continued NSAID therapy (n=79, n=61, respectively)¹

For patients taking multiple NSAIDs including aspirin, a subset analysis of two studies demonstrated significant healing of NSAID-associated GU³



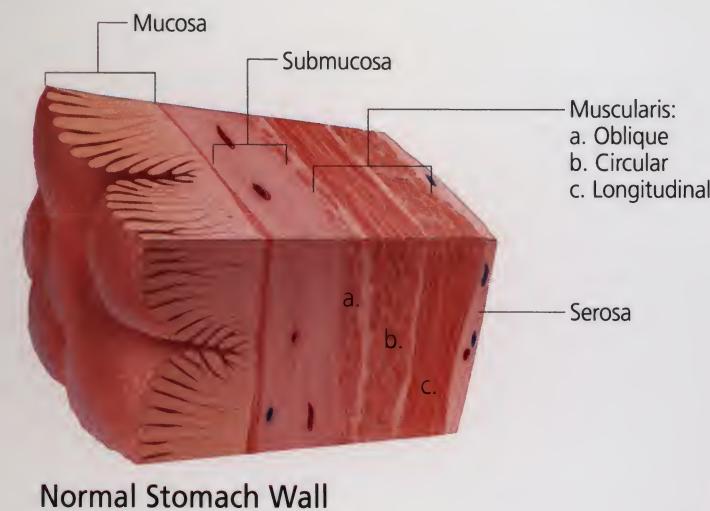
*p=0.005.

In this Rx/OTC subset of patients continuing Rx/OTC NSAIDs including aspirin, mean age was 62 years.³

- In a separate study of patients with active benign gastric ulcers, PREVACID 30 mg QD healed 97% of gastric ulcers by week 8 vs 77% with placebo (n=63, n=64, respectively; p≤0.05)¹
- Please refer to page 9 for important safety information including adverse events



Understanding Ulcers



Normal Stomach Wall

The Stomach

Swallowed food reaches the stomach after being pushed through the esophagus by wavelike muscular contractions called peristalsis. Once in the stomach, food mixes with hydrochloric acid and enzymes produced by the stomach lining to begin the digestion of proteins. This lining produces a layer of mucus to protect itself from the acid. The stomach also functions to store partially digested food for processing later by the small intestine.

Stomach Acid Production

Simple columnar epithelial cells produce *mucus*

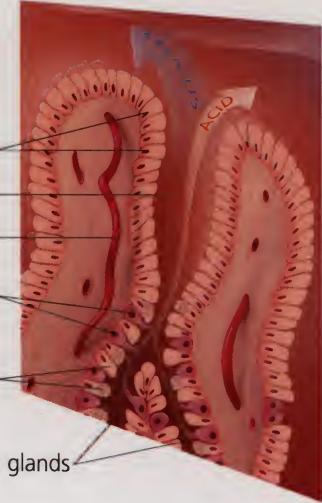
Gastric pit

Capillary

Parietal cells produce *hydrochloric acid*

Goblet cells produce *mucus*

Gastric glands

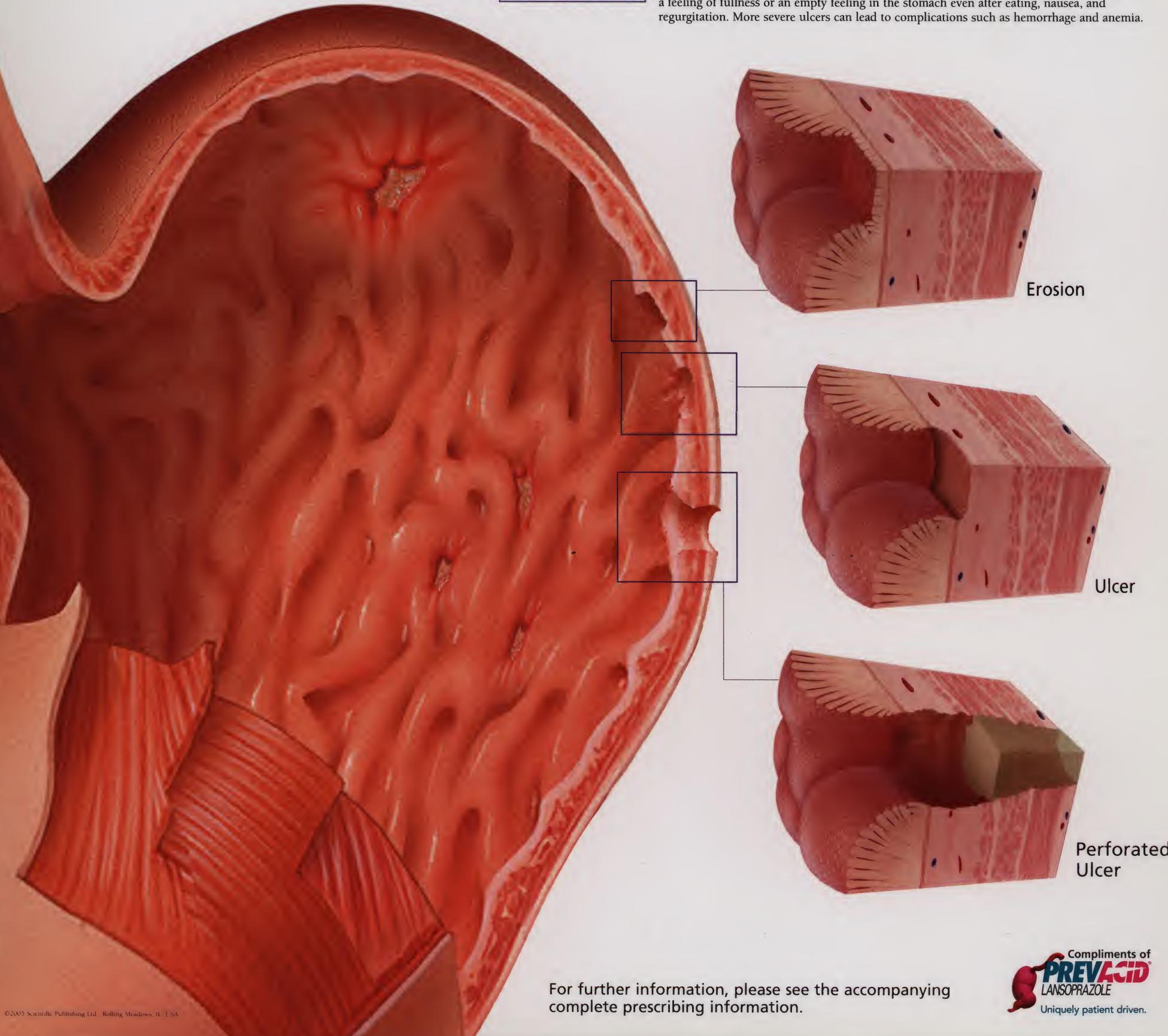


What is a Gastric Ulcer?

Gastric ulcers, also known as peptic ulcers, are open areas in the lining of the gastrointestinal mucosa that have been injured by stomach acids and digestive enzymes (such as hydrochloric acid and pepsin). Two of the primary mechanisms believed to cause ulcers are non-steroidal anti-inflammatory medications (NSAIDs) and a bacteria known as *H. pylori*. These factors can disrupt the normal protective function of the mucosal lining of the stomach and increase the risk of damage from stomach acid. Other risk factors for developing ulcers include stress and smoking.

Gastric ulcers develop in the lining of the stomach and penetrate deeper into the mucosa than erosions. Duodenal ulcers occur only in the upper part of the small intestine.

Symptoms of gastric ulcers are known as dyspepsia, and may occur either chronically or occasionally. Dyspepsia frequently involves abdominal pain and discomfort, bloating, a feeling of fullness or an empty feeling in the stomach even after eating, nausea, and regurgitation. More severe ulcers can lead to complications such as hemorrhage and anemia.



For further information, please see the accompanying complete prescribing information.

Compliments of
PREVACID
LANSOPRAZOLE
Uniquely patient driven.



"I have unique concerns. What are some of my options?"

Patient need	PREVACID SoluTab offers ...
"Is PREVACID affordable?"	The lowest priced branded prescription PPI* ³
"I am going into the hospital."	Multiple administration options [†] : oral, NG tube, oral syringe
"I have a young child."	An easy-to-take, strawberry-flavored tablet approved for GERD patients ≥ 12 months
"I don't like or have difficulty swallowing pills."	A tablet that disintegrates on the tongue usually in <60 seconds ¹

*Based on WAC (Wholesale Acquisition Cost) pricing per oral tablet/capsule published by First DataBank, Inc., April 2005.

WAC is a published price list; actual cost to pharmacy or consumer may differ.

†For detailed administration instructions, please see the dosage and administration section of the accompanying prescribing information.

Phenylketonurics: PREVACID SoluTab contains phenylalanine 2.5 mg per 15 mg tablet and 5.1 mg per 30 mg tablet.

- Cost comparisons do not imply any information regarding efficacy or safety

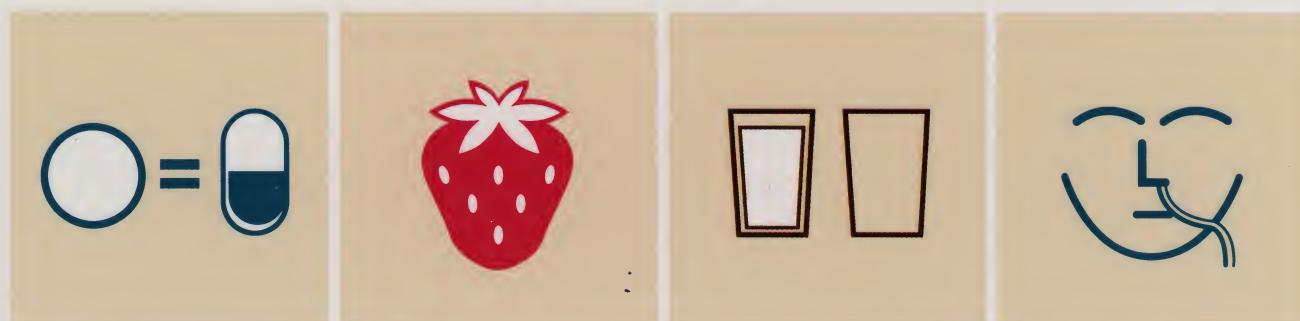
Important Safety and Other Information

• The safety and effectiveness of PREVACID have been established in patients 1 to 17 years of age for the short-term treatment of symptomatic GERD and erosive esophagitis. Use of PREVACID in this age group is supported by evidence from adequate and well-controlled studies in adults along with additional clinical and PK/PD studies performed in pediatric patients. The pediatric studies were uncontrolled, open-label studies performed in 66 patients aged 1 to 11 years old and 87 patients aged

12 to 17 years old. The safety and effectiveness of PREVACID have not been established in patients <1 year of age.

- The most frequently reported adverse events in patients aged 1 to 11 years were constipation (5%) and headache (3%). In patients aged 12 to 17 years, the most frequently reported adverse events were headache (7%), abdominal pain (5%), nausea (3%), and dizziness (3%).

PREVACID SoluTab ...



Is bioequivalent to
PREVACID capsules

Is strawberry
flavored

Place on tongue and
swallow when ready,
with or without water

Can be administered
by NG tube ≥ 8 French

- PREVACID (lansoprazole) products should not be crushed or chewed
- Please refer to page 9 for additional important safety information including adult adverse events



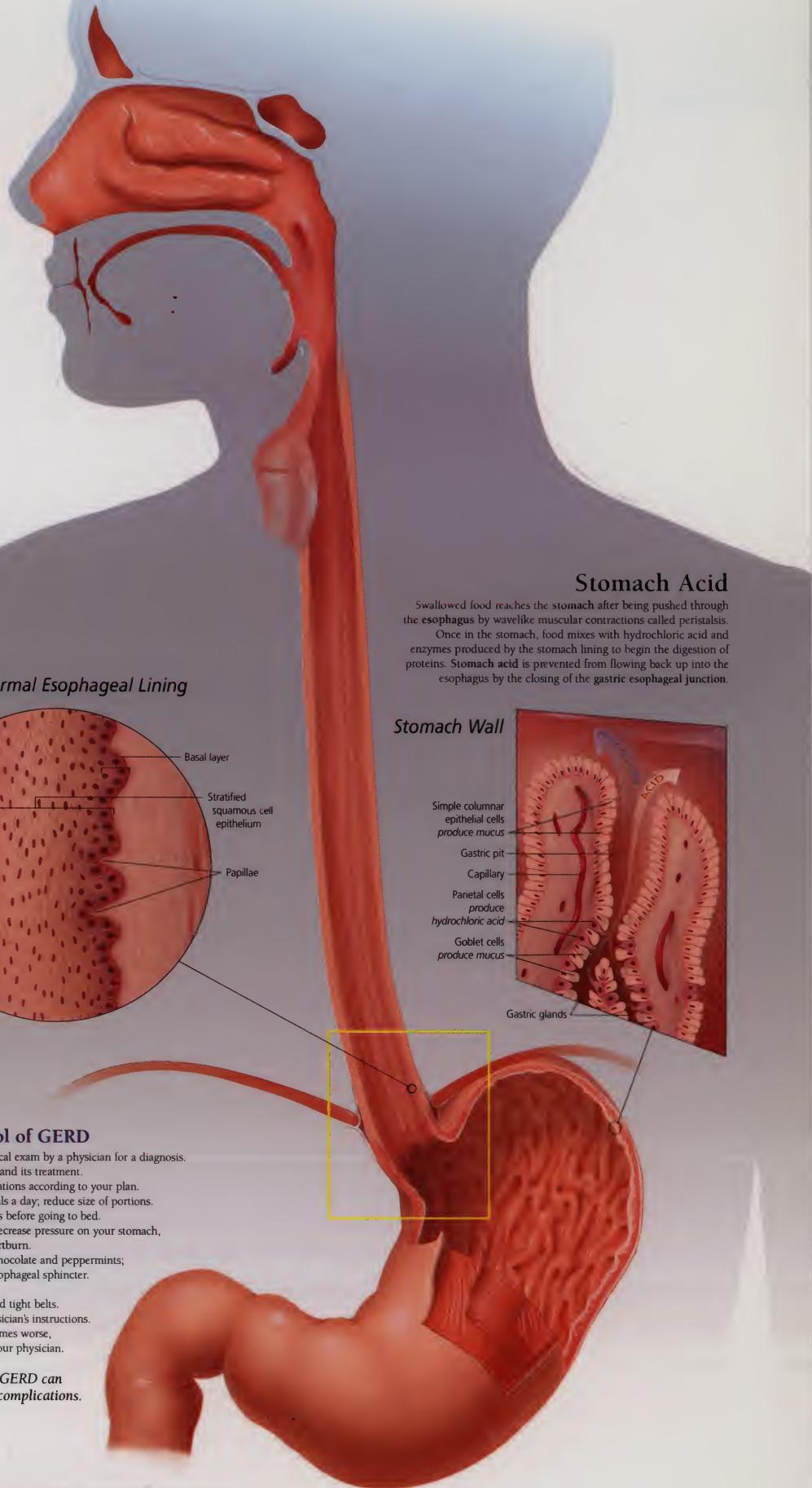


Understanding GERD

(gastroesophageal reflux disease)

What is GERD?

GERD (gastroesophageal reflux disease) or **heartburn** is a frequent discomfort. About 1 in 10 adults has heartburn at least once a week; 1 in 3 has the problem at least once a month. Symptoms include a burning sensation in the chest that may start in the upper abdomen and radiate into the neck. Sour or bitter-tasting material is regurgitated into the throat and mouth, especially when lying down or sleeping. Continual chest discomfort after swallowing hard or liquid foods, inflammation of the esophagus, weight loss and vomiting of blood are symptoms of other problems often associated with GERD. Usually a description of symptoms will allow a physician to establish the diagnosis of heartburn.

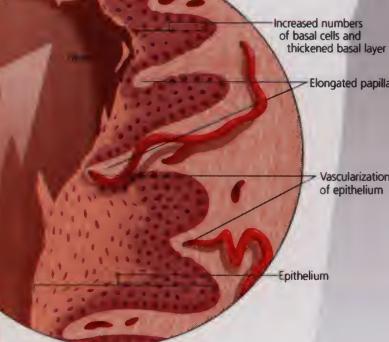


GERD

(gastroesophageal reflux disease)

Under normal circumstances, food passes into the stomach from the esophagus and is prevented from traveling back up the esophagus by the lower esophageal sphincter, which remains tightly closed except when you swallow food. Sometimes, however, the sphincter muscle called the **gastric esophageal junction** becomes weakened and relaxes (opens), allowing acidic stomach contents to move back up the esophagus, producing the symptoms of heartburn.

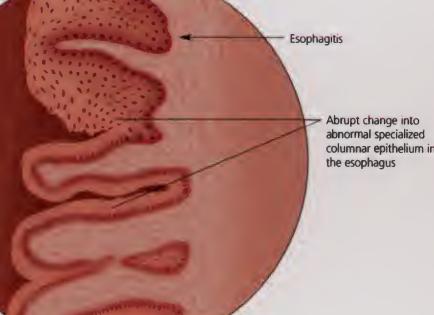
Esophageal Lining with Esophagitis



Esophagitis

When heartburn becomes more frequent, there is a chance of esophagitis, an irritation (inflammation) of the esophageal lining caused by stomach acid. If the esophagitis becomes severe, the result can be bleeding and difficulty in swallowing because of a constriction (stricture) of the esophagus. Some people with severe esophagitis develop Barrett's esophagus.

Esophageal Lining with Barrett's Epithelium



Barrett's Esophagus

In addition to heartburn from a weakened lower esophageal sphincter, many other disorders can result in inflammation of your esophagus. Continual regurgitation of acid from the stomach may damage the normal skin-like lining of the esophagus, which is then replaced by a lining that resembles the lining of the stomach. This new lining usually can resist stomach acid, but inflammation at the upper end of the new lining may narrow (stricture) the interior passageway of the esophagus. Ulcers may occur in the new lining, and can bleed and perforate the esophageal wall. There is a slightly increased risk of cancer occurring in Barrett's esophagus.

Diet and Medication

The ultimate goal of treating heartburn is to produce freedom from symptoms and prevent attacks. Improvements in lifestyle changes and diet alone may be enough to control GERD, especially in mild cases. Often, improvements in diet need to be combined with medication to control GERD. Due to the vast number of mechanisms in the body that affect the digestive system, there are several different types of medications. Your physician will determine which is best for you and may eventually suggest taking more than one.

Acid Blockers decrease acid production in your stomach.

Proton Pump Inhibitors are a newer and more powerful inhibitor of stomach acid production and relieves heartburn more effectively.

Surgery is rare and is only a viable solution for those with severe symptoms, complications despite medication and lifestyle changes.



Cancer of the Esophagus

Most tumors form in the middle or lower part of the esophagus. The principle symptom of an esophageal tumor is progressive difficulty in swallowing. Beginning with solid foods it will eventually become difficult even to swallow liquids. As the condition worsens, weight loss, the regurgitation of food and foul smelling breath probably will occur. Nearly 90 percent of esophageal tumors are malignant. Any difficulty in swallowing requires immediate attention from a physician for diagnostic tests.

Important Safety and Other Information



- PREVACID indications include the treatment of all grades of erosive esophagitis. Most erosions heal in 4 to 8 weeks.
- PREVACID indications include the healing of NSAID-related gastric ulcers in patients continuing NSAID use; controlled studies were conducted up to 8 weeks.
- The most frequently reported adverse events with PREVACID in adults were diarrhea (3.8%), abdominal pain (2.1%), and nausea (1.3%).
- In the risk reduction study of PREVACID for NSAID-associated ulcers, the incidence of diarrhea was 5% and 3% for the PREVACID and placebo groups, respectively.
- Symptomatic response to therapy does not preclude the presence of gastric malignancy. PREVACID formulations are contraindicated in patients with known hypersensitivity to any component of the formulation.
- For further information, please see the accompanying complete prescribing information for PREVACID.

Prescribe PREVACID: The PPI tailored to help you address individual patients' concerns

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1. PREVACID Complete Prescribing Information. 2. Earnest DL, Dorsch E, Jones J, et al. *Am J Gastroenterol.* 1998;93:238-243. 3. Data on file, TAP Pharmaceutical Products Inc.
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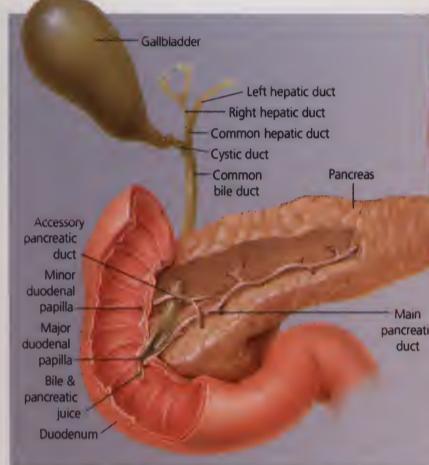
Table of Contents

Digestive System	Plate 1
Diseases of the Digestive System	Plate 2
Understanding IBS <i>Irritable Bowel Syndrome</i>	Plate 3
High Blood Pressure	Plate 4
Effects of Hypertension	Plate 5
Understanding Angina	Plate 6
Understanding Heart Disease	Plate 7
Understanding Stroke	Plate 8
Understanding DVT <i>Deep Vein Thrombosis</i>	Plate 9
Understanding CNS <i>Central Nervous System</i>	Plate 10
Understanding Diabetes	Plate 11
Understanding Cholesterol	Plate 12
COPD <i>Chronic Obstructive Pulmonary Disease</i>	Plate 13
Understanding Asthma	Plate 14
Understanding the Common Cold	Plate 15
COPD/Asthma	Plate 16
The Common Cold vs. the Flu	Plate 17
Understanding Rhinitis	Plate 18
The Effects of Smoking	Plate 19
The Effects of Alcohol	Plate 20
Understanding Hepatitis	Plate 21
Middle Ear Infection	Plate 22
Understanding Glaucoma	Plate 23
Understanding the Teeth	Plate 24
Understanding Skin	Plate 25
Osteoarthritis	Plate 26
Understanding Osteoporosis	Plate 27
Rheumatoid Arthritis	Plate 28
Understanding the Spine	Plate 29
Understanding the Hip & Knee	Plate 30
Understanding the Shoulder & Elbow	Plate 31
Understanding the Foot & Ankle	Plate 32
Understanding the Hand & Wrist	Plate 33
Understanding Menopause	Plate 34
Understanding the Prostate	Plate 35



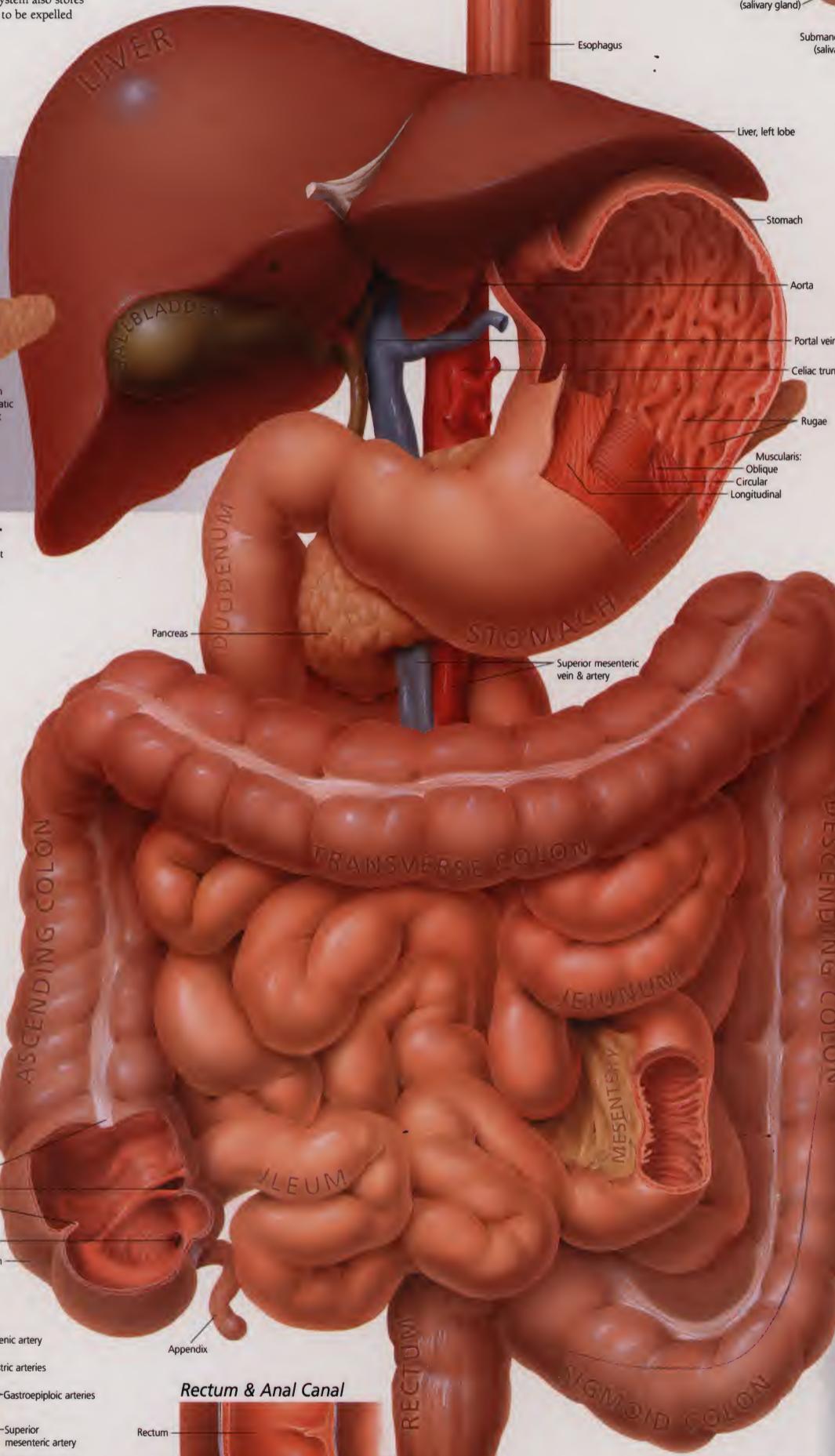
Digestive System

The digestive system, or gastrointestinal tract, is essentially a muscular tube in which intake, digestion and absorption of nutrients takes place. Food, broken down mechanically in the mouth, is propelled through a series of different secretory and absorptive environments. Within these environments, food is broken down further by digestive enzymes into components small enough to be absorbed. The digestive system also stores unabsorbed components until they are ready to be expelled at the end of the gastrointestinal tract.



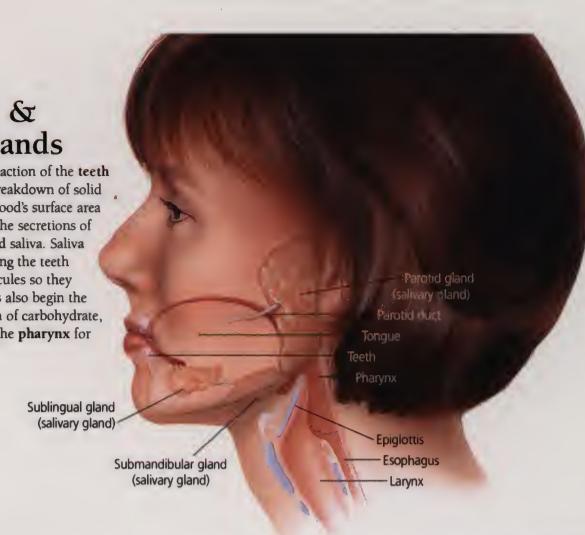
Liver, Pancreas & Gallbladder

After leaving the stomach, chyme moves into the **duodenum**, the first part of the **small intestine**, where it is mixed with bile produced by the liver and pancreatic juice produced by the **pancreas**. Bile acts as a mixing agent on the chyme while the pancreatic juice containing numerous digestive enzymes further breaks down fats, proteins and carbohydrates. Excess bile is stored in the **gallbladder**.



The Mouth & Salivary Glands

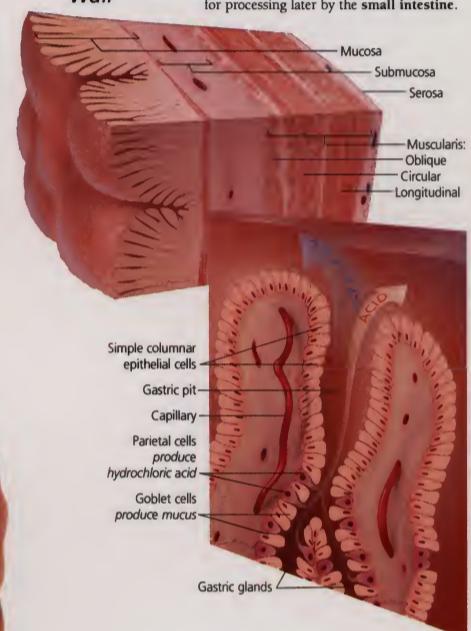
Chewing, the mechanical action of the teeth and tongue, begins the breakdown of solid food. It greatly increases food's surface area and mixes the food with the secretions of the **salivary glands**, called saliva. Saliva acts like a solvent, cleansing the teeth and dissolving food molecules so they can be tasted. Its enzymes also begin the digestion of starch, a form of carbohydrate, and its mucus lubricates the **pharynx** for swallowing.



The Stomach

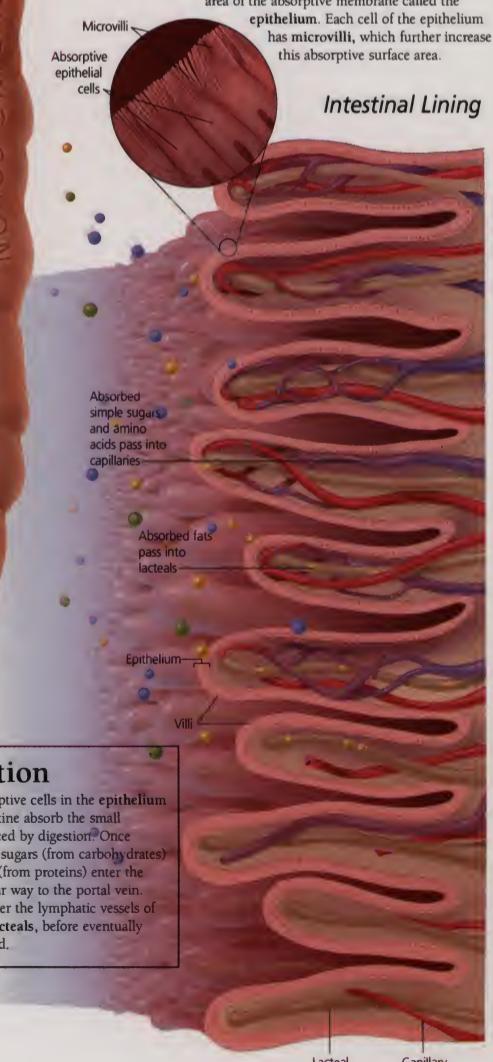
Swallowed food reaches the **stomach** after being pushed through the **esophagus** by wavelike muscular contractions called **peristalsis**. Once in the stomach, food mixes with hydrochloric acid and enzymes produced by the stomach lining to begin the digestion of proteins. This lining produces a layer of mucus to protect itself from the acid. The stomach also functions to store partially digested food, **chyme**, for processing later by the **small intestine**.

Stomach Wall



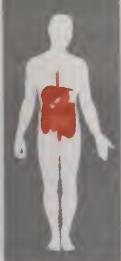
Small Intestine

The **small intestine** consists of three areas, the **duodenum**, **jejunum**, and **ileum**. Digestion occurs throughout the entire length of the small intestine, accompanied by the **absorption** of the resulting molecules by the intestinal wall. **Villi**, projections of the lining of the small intestine, greatly increase the surface area of the absorptive membrane called the **epithelium**. Each cell of the epithelium has **microvilli**, which further increase this absorptive surface area.



Absorption

Absorption
Specialized absorptive cells in the epithelium of the small intestine absorb the small molecules produced by digestion. Once absorbed, simple sugars (from carbohydrates) and amino acids (from proteins) enter the capillaries on their way to the portal vein. Absorbed fats enter the lymphatic vessels of the villi, called **lacteals**, before eventually entering the blood.



Diseases of the Digestive System

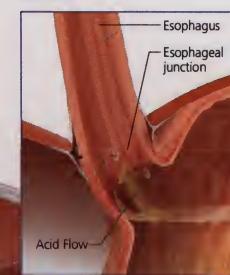
Achalasia

The Esophageal Lining
The esophagus is the portion of the digestive canal between the pharynx and stomach. The esophageal lining can be divided into: a basal proliferate layer, a parabasal layer of cell undergoing terminal differentiation, a flattened layer of superficial cells or squames. At the **gastric esophageal junction** the stratified squamous epithelium is abruptly succeeded by simple columnar epithelium with gastric pits and glands.

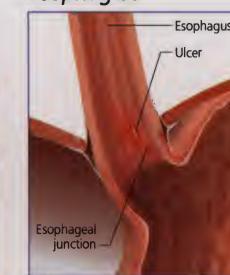
Hiatal Hernia



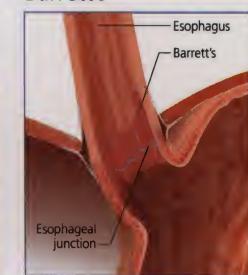
GERD



Esophagitis



Barrett's



Liver, Pancreas & Gallbladder

After leaving the stomach, chyme moves into the duodenum, the first part of the **small intestine**, where it is mixed with bile produced by the **liver** and pancreatic juice produced by the **pancreas**. Bile acts as a mixing agent on the chyme while the pancreatic juice containing numerous digestive enzymes further breaks down fats, proteins and carbohydrates. Excess bile is stored in the **gallbladder**.

The digestive system, or **gastrointestinal tract**, is essentially a muscular tube in which intake, digestion and absorption of nutrients takes place. Food, broken down mechanically in the mouth, is propelled through a series of different secretory and absorptive environments. Within these environments, food is digested (broken down) by digestive enzymes into components small enough to be absorbed. The digestive system also stores unabsorbed components until they are ready to be expelled at the end of the gastrointestinal tract.

Small Intestine

The small intestine consists of three areas, the **duodenum**, **jejunum**, and **ileum**. Digestion occurs throughout the entire length of the small intestine, accompanied by the **absorption** of the resulting molecules by the intestinal wall. **Villi**, projections of the lining of the small intestine, greatly increase the surface area of the absorptive membrane called the **epithelium**. Each cell of the epithelium has **microvilli**, which further increase this absorptive surface area.

Duodenal Ulcer

IBS (Irritable Bowel Syndrome)

Colon spasm

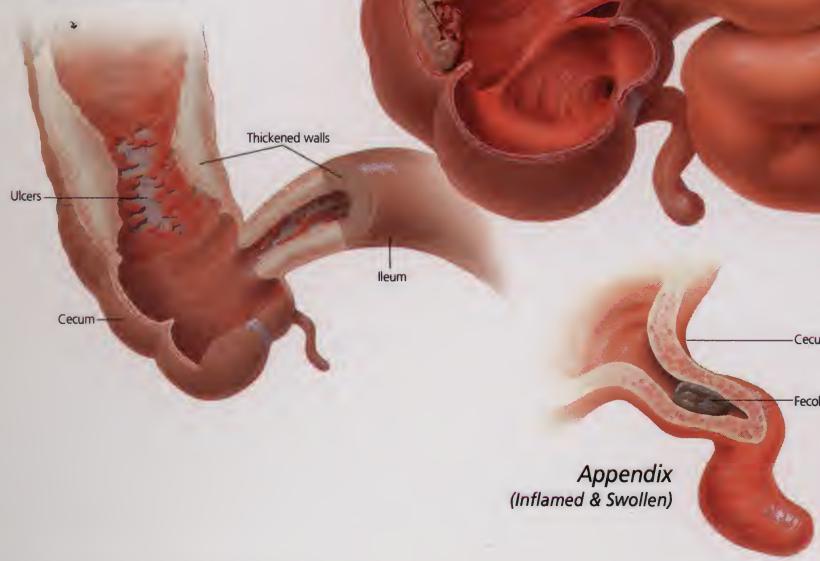
Ulcerative Colitis



Cancer

Carcinoma of colon

Crohn's Disease



Intussusception



Hemorrhoids

Internal

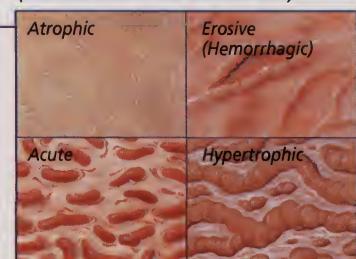
External

The Stomach

Swallowed food reaches the **stomach** after being pushed through the **esophagus** by wavelike muscular contractions called **peristalsis**. Once in the stomach, food mixes with hydrochloric acid and enzymes produced by the stomach lining to begin the digestion of proteins. This lining produces a layer of mucus to protect itself from the acid. The stomach also functions to store partially digested food, chyme, for processing later by the **small intestine**.

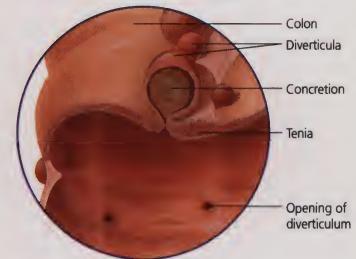
Types of Gastritis

(Inflammation of the stomach wall)



Diverticulosis

(Inflammation of diverticula)



Polyps

Sessile
Pedunculated

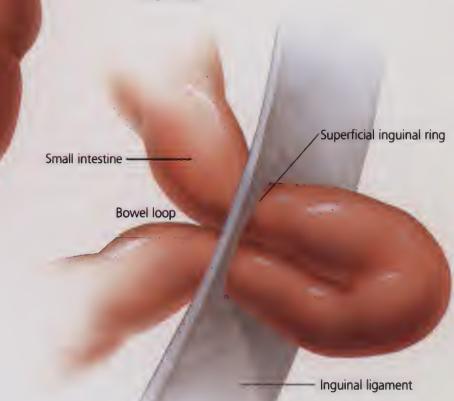
Large Intestine

The large intestine consists of the **cecum**, the **colon** (ascending, transverse, descending and sigmoid) and the **rectum**. As undigested material enters the large intestine, water and electrolytes are absorbed. The remaining waste is stored, formed and expelled.

Cancer

Carcinoma of small intestine

Hernia





Understanding IBS

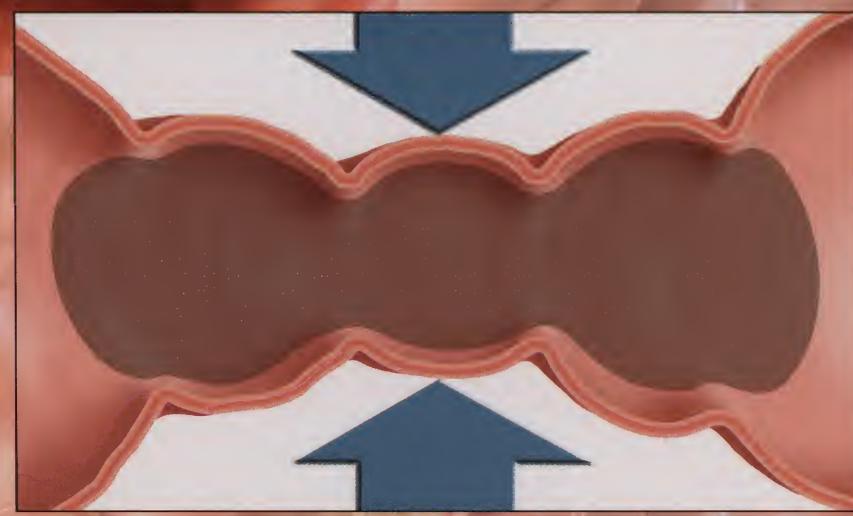
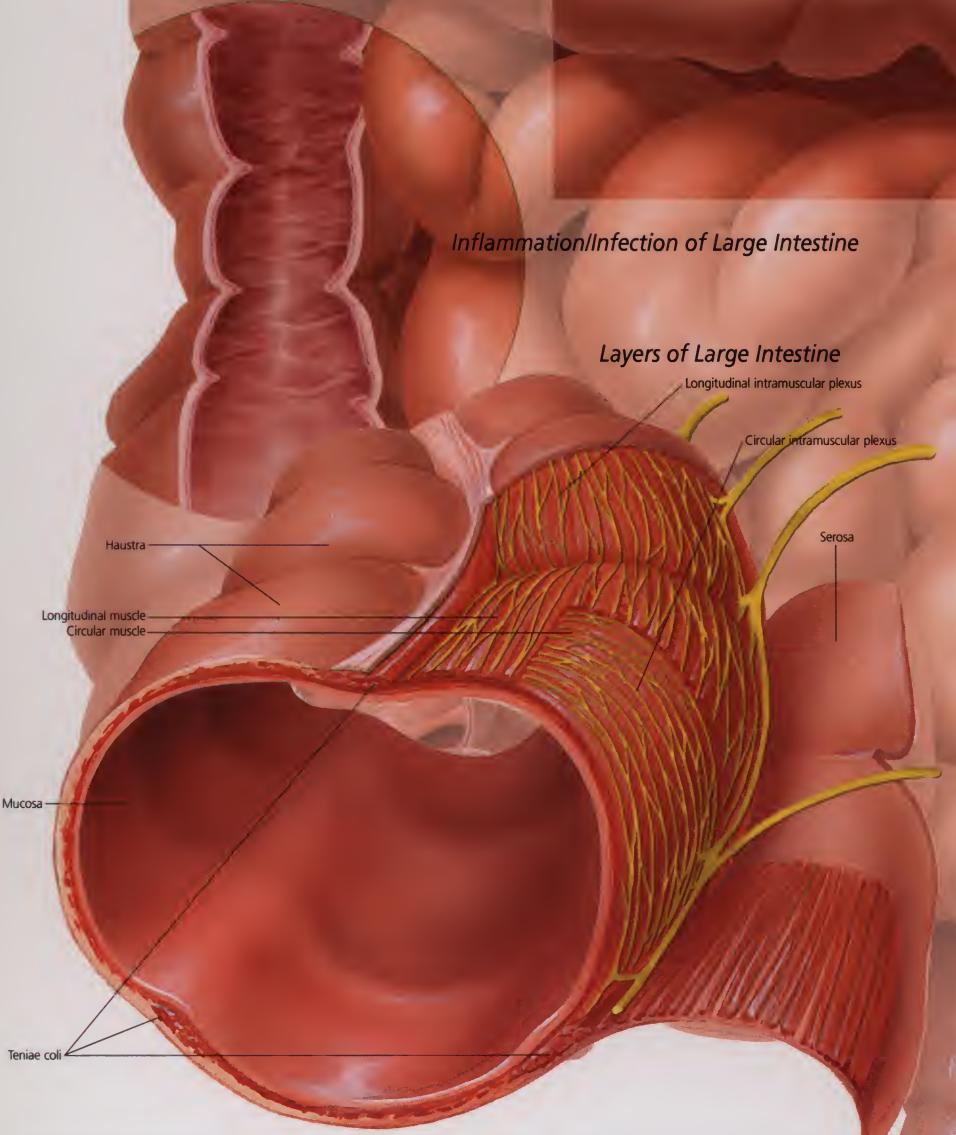
Irritable Bowel Syndrome

What is IBS?

Irritable Bowel Syndrome (IBS) is a functional disorder affecting the large intestine, or colon. In IBS, the colon isn't working properly, leading to chronic and recurrent abdominal discomfort or pain and bowel habit changes. Over the years IBS has been called different names, such as spastic colon and mucous colitis. Irritable Bowel Syndrome has not been shown to lead to other diseases.

Possible Causes of IBS

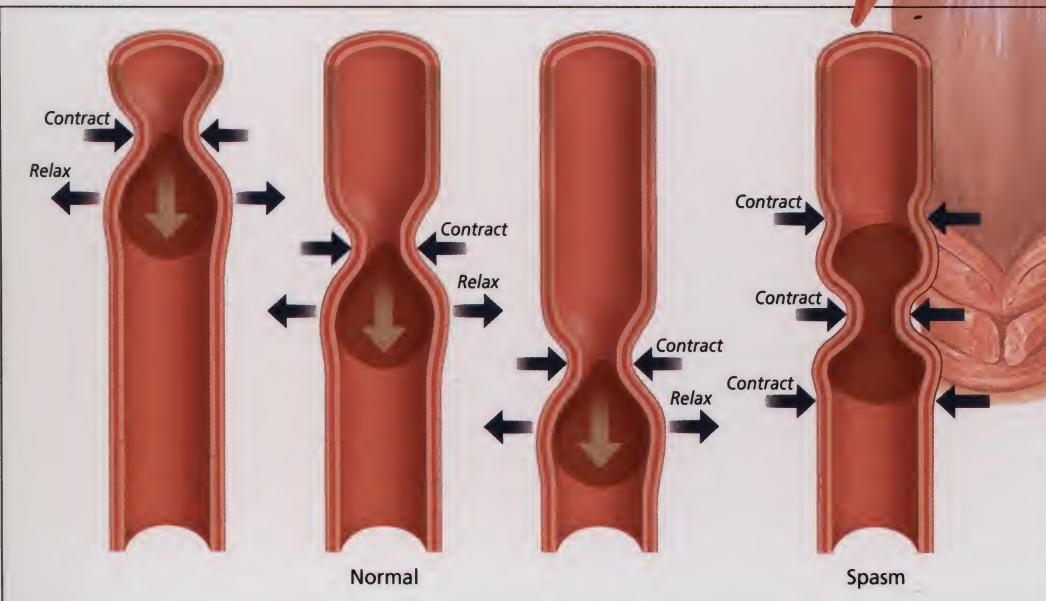
The cause of Irritable Bowel Syndrome is unknown. Since IBS is a functional disorder, there is no infection, inflammation or structural changes to be seen. People with IBS seem to have increased colon sensitivity. Their colon muscles spasm, or suddenly contract, after only mild stimulation. This increased gut sensitivity may result from a problem in the interaction of the brain, the intestines and the autonomic nervous system. The most likely triggers of IBS symptoms are diet, emotional stress and hormonal changes. IBS may, in some cases, be the result of another disease.



Symptoms

Normal bowel function varies from one person to the next, and most people have a bowel disturbance from time to time. People with IBS may experience chronic and recurrent abdominal discomfort or pain and bowel disturbances, such as diarrhea, constipation, or alternating diarrhea and constipation. Other symptoms may include:

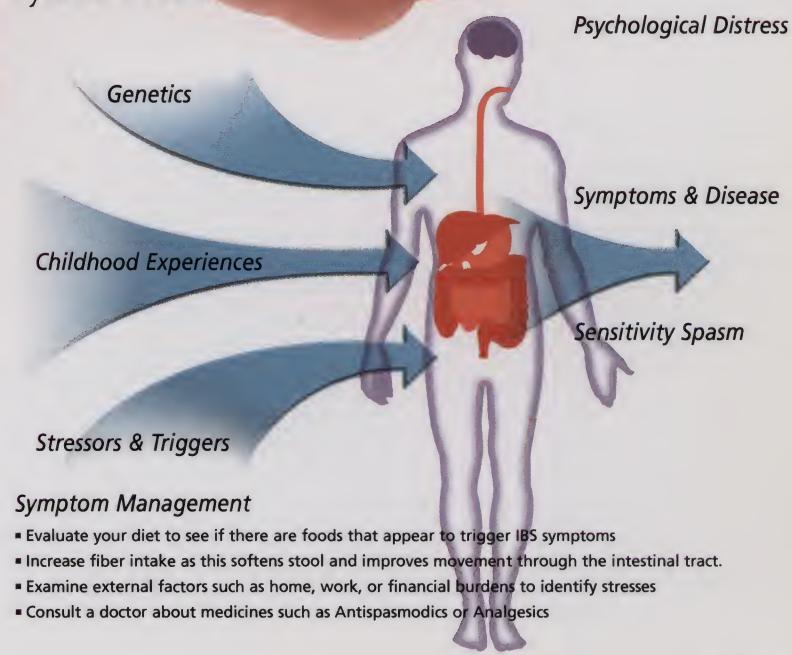
- Change in frequency of bowel movements
- Abdominal pain relieved by defecation
- Bloating
- Excessive amount of gas
- Passage of mucus with a bowel movement
- Feeling that the bowel is not completely empty
- Nausea



Peristaltic Action

Waste material is moved through the colon by a series of muscle contractions called peristalsis. The contraction of the muscle behind the material moves it into the next section of colon, where the muscle has relaxed. In IBS, spasms interrupt the process, producing discomfort or pain and bowel disturbances.

System Overview of IBS



Symptom Management

- Evaluate your diet to see if there are foods that appear to trigger IBS symptoms
- Increase fiber intake as this softens stool and improves movement through the intestinal tract.
- Examine external factors such as home, work, or financial burdens to identify stresses
- Consult a doctor about medicines such as Antispasmodics or Analgesics



High Blood Pressure

What Is Blood Pressure?

Blood pressure is the force of circulating blood against the inner walls of the blood vessels. It is affected by:

- how hard the heart pumps
- the amount of blood in the body
- the diameter of the blood vessels

Generally, blood pressure increases when the heart pumps harder, the amount of blood in the body increases or the diameter of the blood vessels decreases.

What Is High Blood Pressure?

One out of five adults in the U.S.—more than 50 million people—has high blood pressure. The term **hypertension** is also used to describe this condition, but it does not refer to being anxious or tense. It occurs when blood is flowing through the vessels at a pressure that is too high for the long-term health of the blood vessels. Generally, a blood pressure of 140 over 90 or higher is considered unhealthy. Over time, vessel walls exposed to these levels of pressure become damaged. This damage can lead to serious health problems.

What Causes High Blood Pressure?

Occasionally, high blood pressure is caused by a disease. This type is called **secondary hypertension**. Most people with high blood pressure have a type called **essential or primary hypertension**. Although there are many theories about primary hypertension, the exact cause is unknown. It is possible that several complex mechanisms are involved.

Risk Factors

- Family history of high blood pressure
- Race (African Americans have the highest incidence)
- Age (risk increases with age)
- Obesity
- Sedentary lifestyle
- Diabetes mellitus

Measuring Blood Pressure

Blood pressure is a measurement consisting of a top number, **systolic pressure** (pressure when the heart is contracting), and a bottom number, **diastolic pressure** (pressure when the heart is resting). It is measured with a pressure cuff and sphygmomanometer. The cuff is placed around the upper arm and tightened until blood flow through the brachial artery is stopped. Pressure, read from the attached meter, is gradually decreased in the cuff while a stethoscope is used to listen to the brachial artery. Sounds heard in the artery indicate the blood pressure. Blood pressure can be measured this way because blood makes noise when its flow is restricted:

Artery is blocked: no movement of blood—silence

Systolic pressure, artery begins to open: blood flow is turbulent—sounds are heard

Diastolic pressure, artery is completely open: blood flows smoothly through the artery—silence

The average blood pressure reading of a healthy adult is approximately:

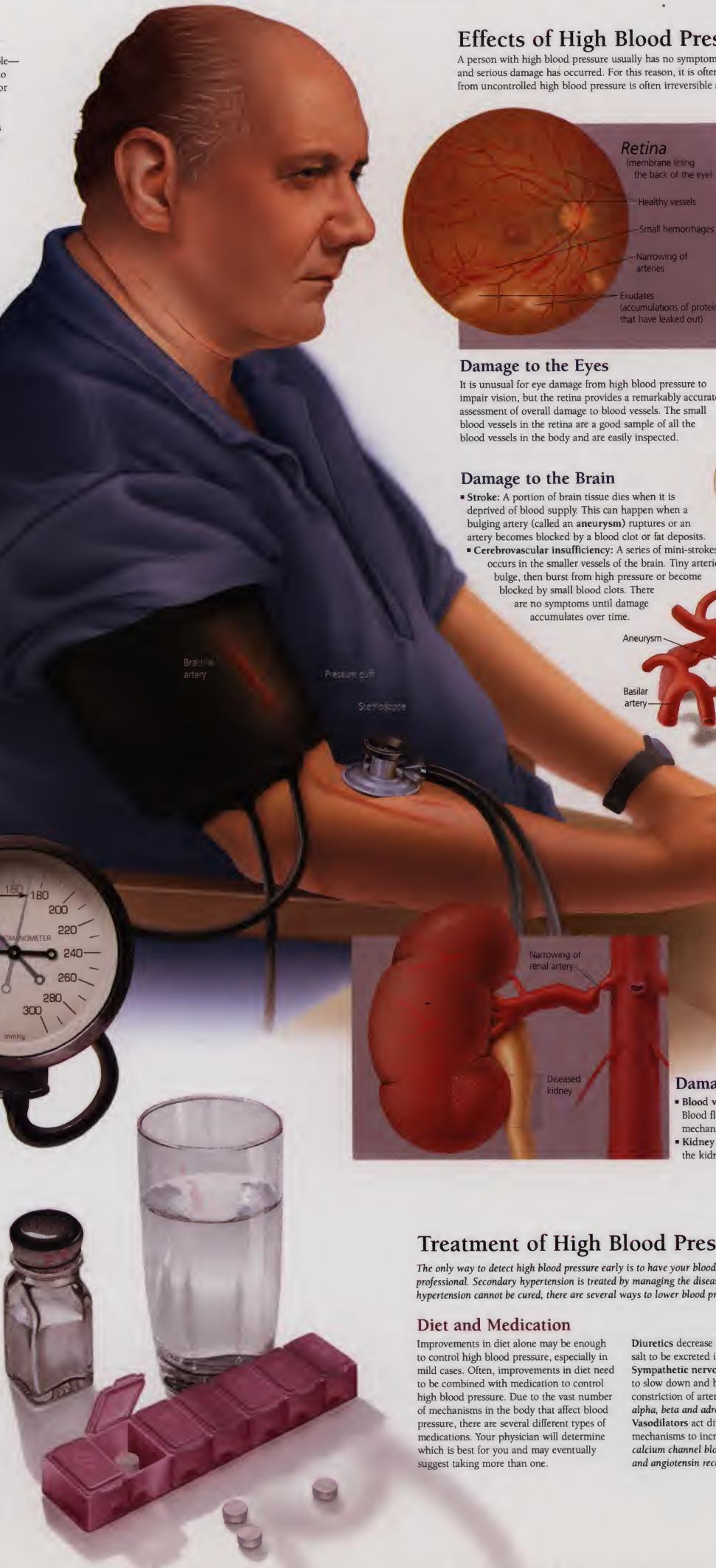
120

80

Salt and Blood Pressure

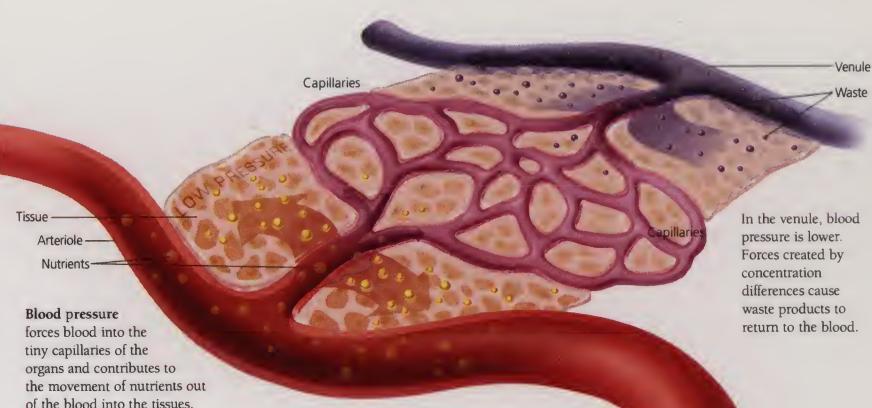
Blood pressure and blood concentration of salt are closely related. When you eat salty foods, blood concentration goes up. Almost immediately, water is added to the blood by the kidneys so that blood concentration returns to normal. Additional water in the bloodstream elevates blood pressure. Blood pressure will stay elevated until the body is able to excrete the excess salt and water.

People with high blood pressure should watch their intake of salt. Although the exact role of salt is unknown, it is possible that some people with high blood pressure have a decreased ability to excrete it. Also, low salt intake may increase the effectiveness of medication.



Importance of Pressure

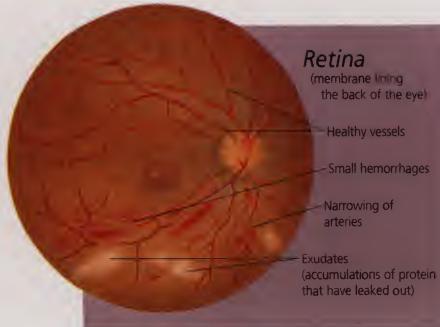
Arterial blood carries essential materials such as oxygen and other nutrients to every cell in the body. Without an adequate supply of blood, organs and tissues cannot survive. Venous blood carries waste products away from the cells to be discarded. Both blood pressure and concentration must be within certain levels for this crucial exchange of nutrients and waste to occur. Fortunately, the body is armed with a web of complex mechanisms that monitor pressure and concentration and act to keep both within normal ranges.



In the venule, blood pressure is lower. Forces created by concentration differences cause waste products to return to the blood.

Effects of High Blood Pressure

A person with high blood pressure usually has no symptoms until he or she has had it for quite some time and serious damage has occurred. For this reason, it is often called the "silent killer." Long-term damage from uncontrolled high blood pressure is often irreversible and can lead to an early death.

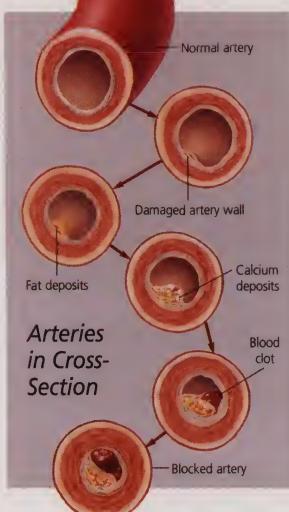


Damage to the Eyes

It is unusual for eye damage from high blood pressure to impair vision, but the retina provides a remarkably accurate assessment of overall damage to blood vessels. The small blood vessels in the retina are a good sample of all the blood vessels in the body and are easily inspected.

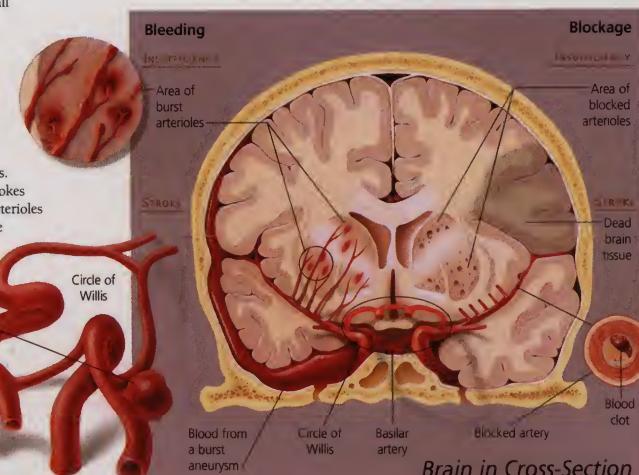
Damage to Blood Vessels

Artery walls become damaged from high pressure. Fat accumulates and the walls thicken. Calcium is deposited in the fatty areas, "hardening" the arteries, making them unable to increase in size. Blood flow through the arteries decreases. Damaged artery walls may also cause blood clots to form which block the artery itself or break off and block arteries in other organs.



Damage to the Brain

- **Stroke:** A portion of brain tissue dies when it is deprived of blood supply. This can happen when a bulging artery (called an **aneurysm**) ruptures or an artery becomes blocked by a blood clot or fat deposits.
- **Cerebrovascular insufficiency:** A series of mini-strokes occurs in the smaller vessels of the brain. Tiny arterioles bulge, then burst from high pressure or become blocked by small blood clots. There are no symptoms until damage accumulates over time.



Damage to the Heart

- **Heart disease leading to heart attack:** Fat deposits and blockages form in the arteries that supply the heart with blood.

- **Congestive heart failure:** Heart becomes damaged and enlarged from working so hard to pump blood against the higher blood pressure.

Damage to the Kidneys

- **Blood vessel damage:** Arteries become narrowed and stiff from high pressure. Blood flow to the kidneys is decreased. Receptors respond by recruiting mechanisms throughout the body to raise overall blood pressure even further.
- **Kidney disease leading to failure:** It becomes more and more difficult for the kidneys to remove impurities from the blood. Toxic materials accumulate.



Treatment of High Blood Pressure

The only way to detect high blood pressure early is to have your blood pressure measured by a healthcare professional. Secondary hypertension is treated by managing the disease that is causing it. Although primary hypertension cannot be cured, there are several ways to lower blood pressure and keep it controlled:

Diet and Medication

Improvements in diet alone may be enough to control high blood pressure, especially in mild cases. Often, improvements in diet need to be combined with medication to control high blood pressure. Due to the vast number of mechanisms in the body that affect blood pressure, there are several different types of medications. Your physician will determine which is best for you and may eventually suggest taking more than one.

Diuretics decrease blood volume by causing more water and salt to be excreted in the urine. **Sympathetic nervous system blocking drugs** cause the heart to slow down and beat less forcefully. They also decrease constriction of arteries throughout the body. **Examples are alpha, beta and adrenergic blockers.** **Vasodilators** act directly on blood vessel walls or through other mechanisms to increase blood vessel diameter. **Examples are calcium channel blockers, ACE inhibitors, angiotensin II inhibitors, and angiotensin receptor blockers.**

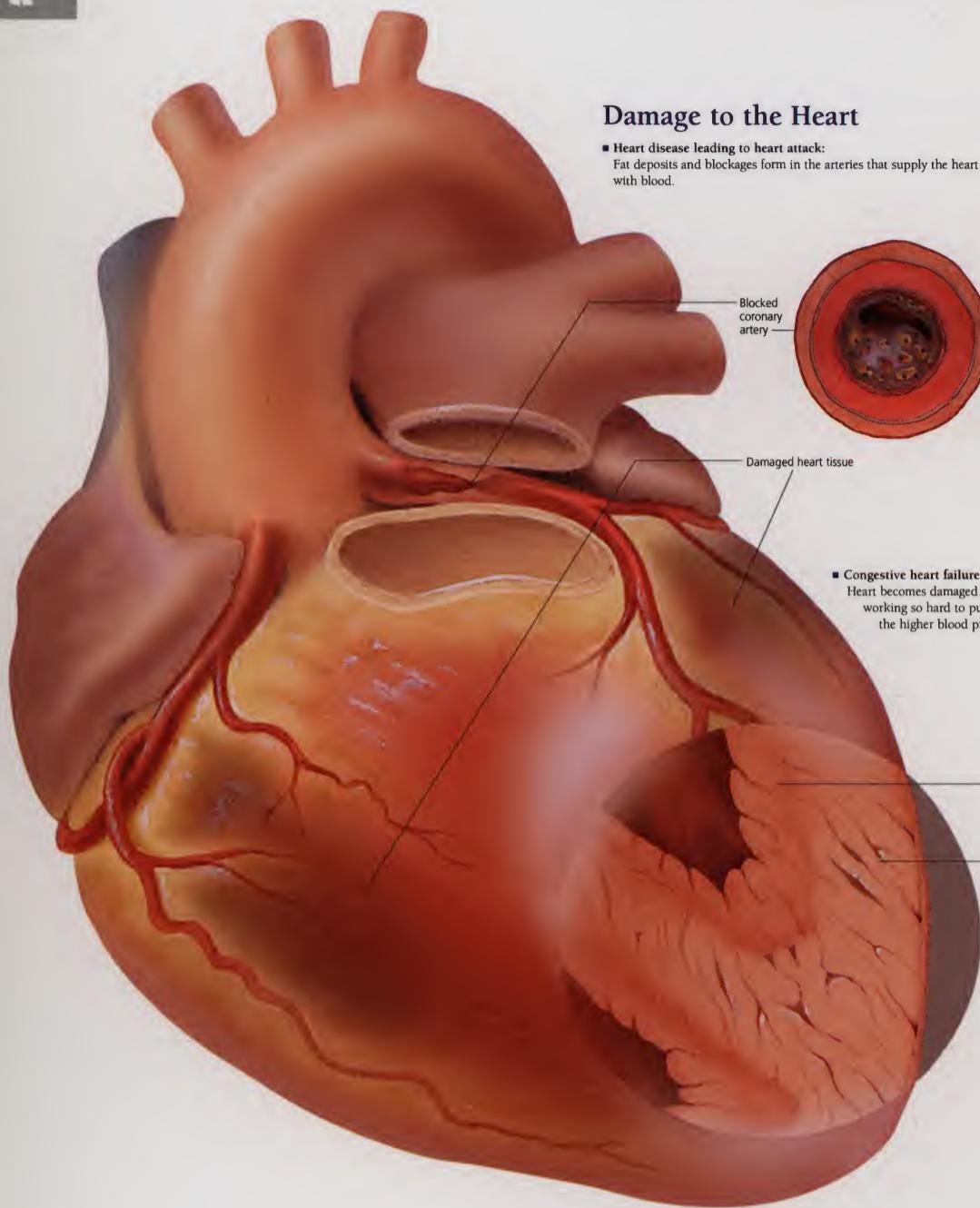
Taking Control of Your Blood Pressure

- Maintain a low-fat diet.
- Decrease salt intake to less than a teaspoon per day (2000 mg).
- Shed extra weight to decrease strain on your heart.
- Don't smoke.
- Restrict caffeine and alcohol consumption.
- Follow all of your physician's instructions.
- Take prescribed medications as part of your daily routine.
- Consult your physician about an appropriate exercise plan and follow it.
- Measure blood pressure regularly at home.
- Continue taking medication even after your blood pressure has reached a good level.

Effective control of high blood pressure can prevent most of its complications.



Effects of Hypertension

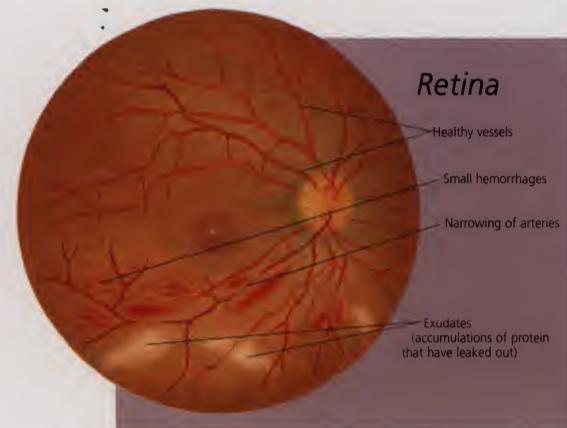


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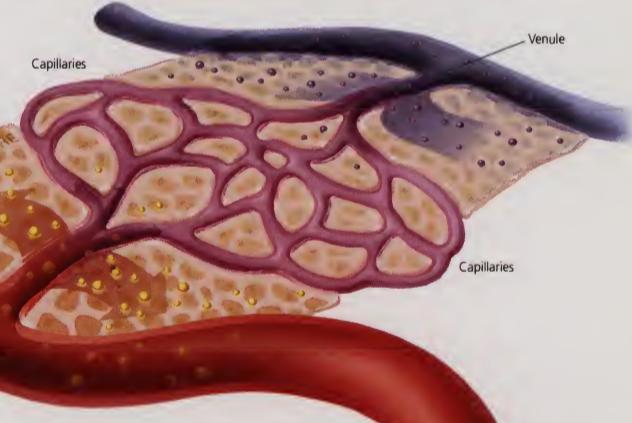
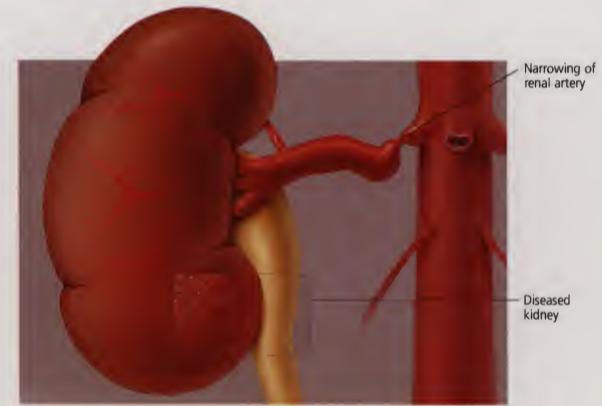


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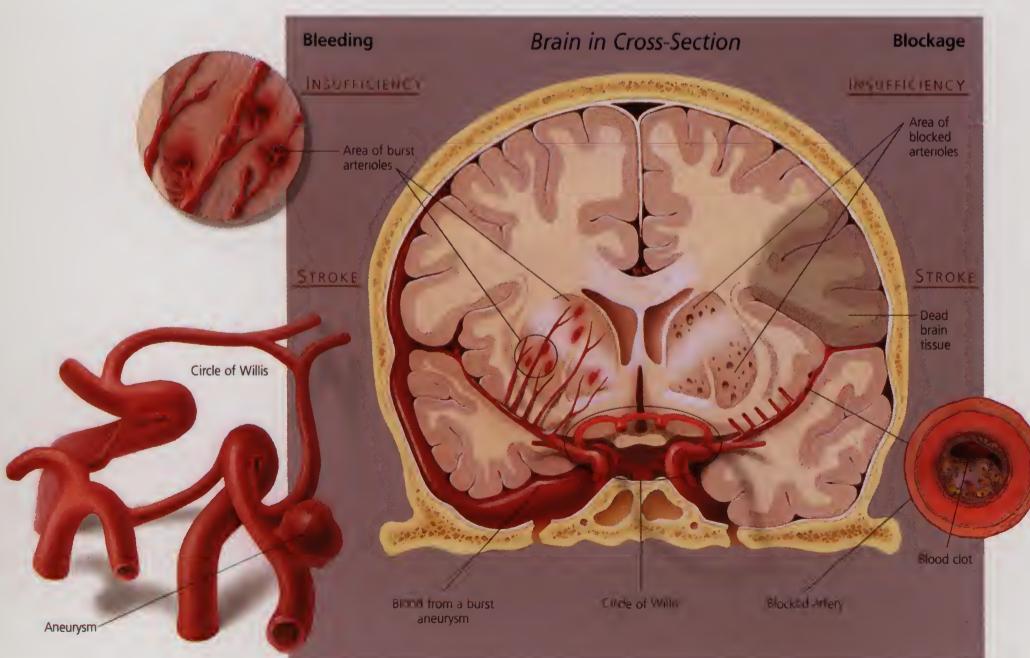
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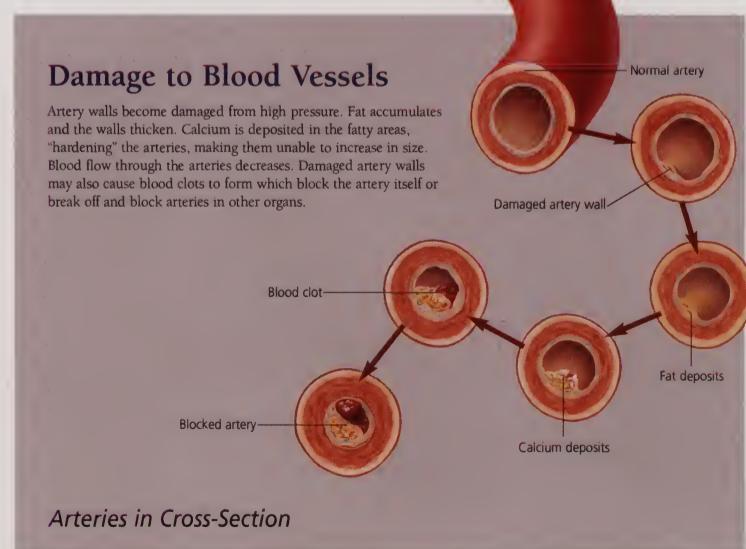
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Damage to Blood Vessels

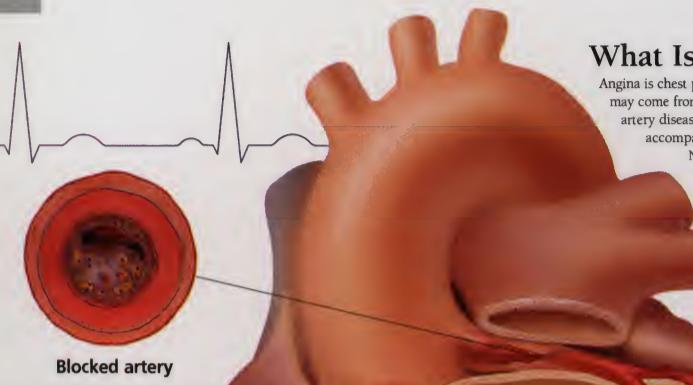
Artery walls become damaged from high pressure. Fat accumulates and the walls thicken. Calcium is deposited in the fatty areas, "hardening" the arteries, making them unable to increase in size. Blood flow through the arteries decreases. Damaged artery walls may also cause blood clots to form which block the artery itself or break off and block arteries in other organs.



Arteries in Cross-Section

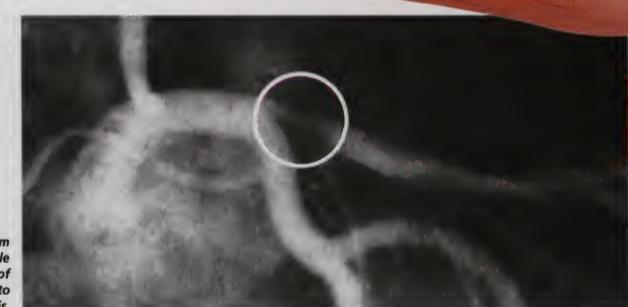


Understanding Angina



Angina Warning Symptoms Include:

- Pain that seems to affect your entire chest area.
- Pain that seems to randomly move through the arm, neck and shoulders and possibly other parts of the body.
- A feeling of nausea, indigestion or heartburn.
- Pain lasting no more than 15 minutes.
- Light-headed feeling, with a sense of anxiety and nervousness.



A coronary angiogram of a heart. The circle indicates a narrowing of a major artery due to atherosclerosis.

Diagnosing Angina

The initial warning sign is chest pain during physical activity. However, any time a feeling of chest tightness occurs, whether during mild exertion or even at sleep, angina could be the cause. It is sometimes confused with indigestion, but commonly causes pain in shoulders, neck and arms.

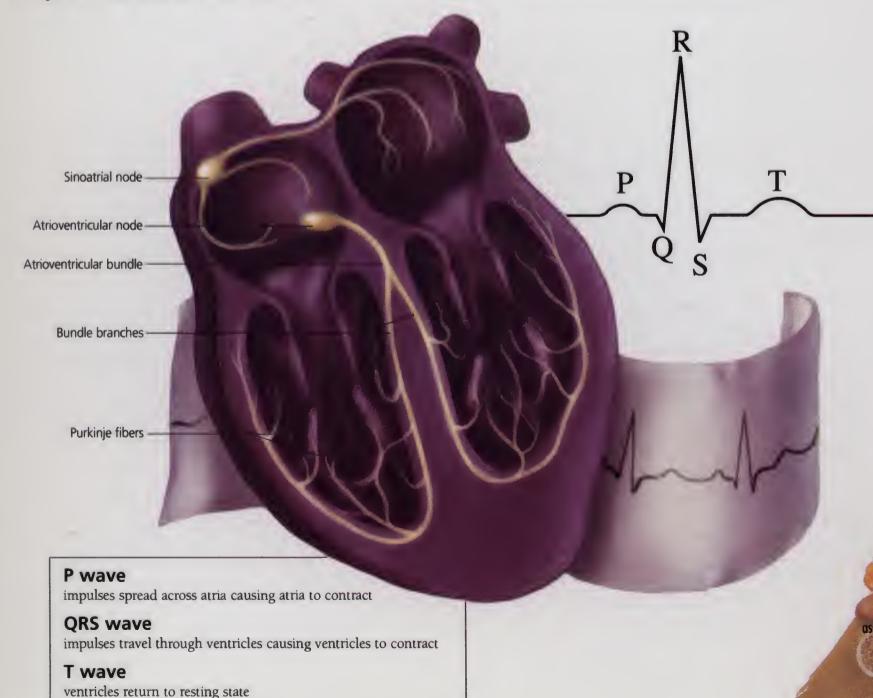
The most accurate way to assess angina is by a **coronary angiogram**, an x-ray of the coronary artery. A dye is injected into the blood stream and the x-ray shows the coronary arteries and their narrowing.

Physicians might use an **electrocardiogram** or ECG to evaluate the heart for damage. The next procedure after a electrocardiogram may be a **stress test**. The ECG is performed while walking on treadmill.

There are also heart enzyme levels the physician can examine to eliminate angina. Other conditions such as anemia or thyroid abnormalities might place stress on the heart and cause angina.

Electrical Pathways

The steady beating of the heart is regulated by electrical impulses traveling through the heart. The impulses originate in the **sinoatrial node**, also known as the body's pacemaker. The impulses spread across the atria, causing them to contract. Next the impulses travel to the **atrioventricular node**, pause, then spread through the ventricles along special conduction pathways called **bundle branches** and **Purkinje fibers**. This causes the ventricles to contract.



What Is Angina?

Angina is chest pain due to restricted blood flow to the **myocardium** (heart muscle). Restricted blood flow may come from blockages in the arteries that supply blood to the heart. This condition is called coronary artery disease. Angina usually occurs during physical activities, eating or stress and is often accompanied with sweating and difficulty in breathing. Angina is a symptom, not a disorder.

Not all chest pain is angina; your physician can make the proper diagnosis.

Types of Angina:

Stable Angina -

The most common variety of angina that follows somewhat predictable patterns.

Unstable Angina -

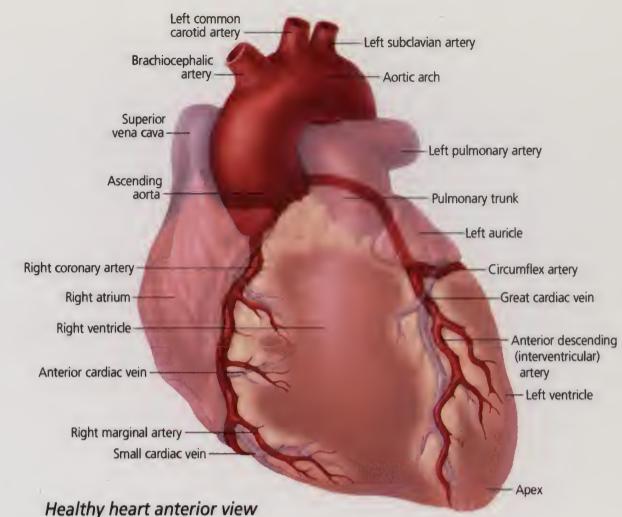
Prolonged angina with symptoms that suggests a heart attack without physical or diagnostic evidence. Less responsive to rest and medication.

Prinzmetal's Angina -

A rare form of angina that is caused by vasospasm, a spasm that narrows the coronary artery to the heart.

Microvascular Angina -

Poor functioning of tiny blood vessels in the heart that do not supply proper blood flow. Not associated with typical coronary artery blockages.



Healthy heart anterior view

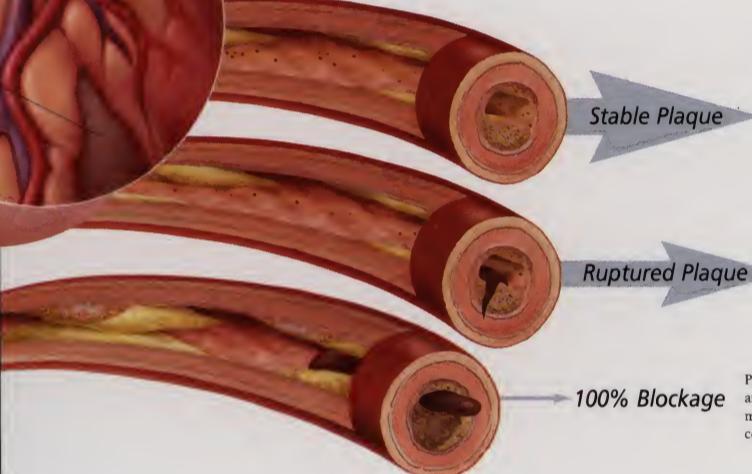
Blood Supply to the Heart

The coronary arteries supply the myocardium, the muscular layer of the heart wall, with oxygen and nutrients. These arteries originate from the aorta and lie within the epicardium, the outermost layer of the heart wall. Smaller arterial branches penetrate the myocardium. The **cardiac veins** collect venous blood from the heart wall and return it to the right atrium.

What Causes Angina?

Angina is caused by insufficient blood flow to the heart. This could be the result of an artery obstruction due to a buildup of plaque, known as atherosclerosis. It can be the result of diabetes, an inactive lifestyle or smoking. Physical activity may provoke the attack in a person with an existing risk for angina. Other less common causes of angina are abnormal heart rhythms or heart valves.

Damage to the Blood Vessels (Atherosclerosis)



One of the primary causes of angina is atherosclerosis, which most people term "hardening of the arteries." This is a buildup of cholesterol, minerals, blood and muscle cells in the artery wall. The presence of these substances causes the artery to become stiffer and can cause the blood flow to be blocked to some degree. Plaque is the term used to describe this buildup. A minimal amount of plaque may not cause significant harm; this stage is known as **stable plaque**.

If plaque develops further and breaks up, termed **ruptured plaque**, it may have quick and damaging effects. When the rupture occurs it releases harmful enzymes and other substances, potentially causing a blood clot. The blood clot may restrict the artery at the point of the rupture or travel through the bloodstream to cause a stroke, a heart attack, or kidney failure.

Plaque formation can progress if unchecked to completely block the artery. This may prevent enough oxygen from reaching vital heart muscle tissue. The lack of oxygen may lead to debilitating heart conditions.

Damage to the Heart

Heart disease leading to heart attack: Fat deposits and blockages form in the arteries that supply the heart with blood.

Congestive heart failure: Heart becomes damaged and enlarged from working so hard to pump blood against the higher blood pressure.

The Treatment of Angina

Lifestyle changes

A healthy lifestyle is a primary component in the treatment of angina. This includes eating habits and exercise. Those who are active and control their weight lessen their risk of angina.

Physicians may prescribe cardiac medications such as nitroglycerin to increase the blood flow to the coronary system by expanding coronary blood vessels. Beta-adrenergic blockers might be used to slow the heartbeat, to relieve stress on the heart. Physicians might suggest aspirin because it is known to dissolve blood clots.

Cholesterol Control

The control of "bad" cholesterol or LDL may be instrumental in preventing future attacks. Physicians most often prescribe statins to reduce LDL to 100 mg/dL or below. They have limited side effects, but must be used with a low-fat diet to achieve the best results.

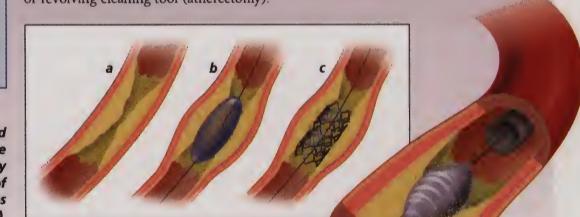
Smokers may reduce their incidence of heart attack by 50% if they are smoke-free for at least a year. The longer the period without smoking the greater the benefit. After five to ten years, their risk of a heart attack is the same as for one who has never smoked.

Taking Control of Your Angina

- Controlling physical activity – Consult your physician about an appropriate exercise plan and follow it.
- Shed extra weight to decrease strain on your heart.
- Maintain a low-fat diet.
- Decrease salt intake to less than a teaspoon per day.
- Don't smoke.
- Restrict caffeine and alcohol consumption.
- Follow all of your physician's instructions.
- Avoid any unnecessary emotional disturbances.
- Take prescribed medications as part of your daily routine.
- Measure blood pressure regularly at home.

Exercising has many benefits, especially reducing the risk of heart problems. Exercise may improve the levels of "good" or HDL cholesterol and reduce blood pressure in most cases. Patients should always consult their physician on the type of exercise program.

Surgical procedures might include a heart bypass, which requires placing veins in such a way to replace the function of the obstructed artery. A less extensive procedure is balloon angioplasty. This is when a catheter is inserted in an affected artery and a balloon is inflated to expand the passageway. A common second step in the procedure is to place a stent in a passage to give the artery the best chance of staying open. Additional surgical procedures utilize a catheter to enter the blocked artery and eliminate the obstruction with a laser (laser angioplasty) or revolving cleaning tool (atherectomy).



Atherectomy is a surgical procedure that removes plaque buildup in arteries using a revolving cleaning tool



Medications can significantly reduce both the effects and risk of angina attacks. These also decrease the chances that a patient with angina will have a heart attack.

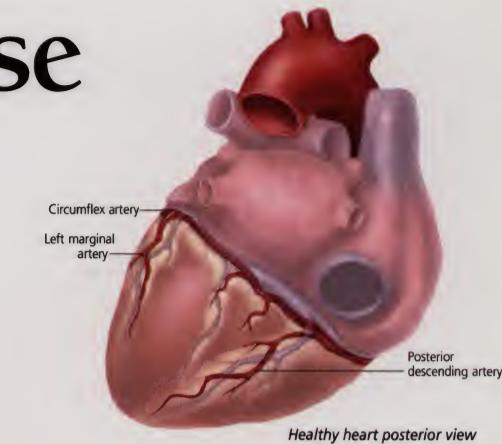
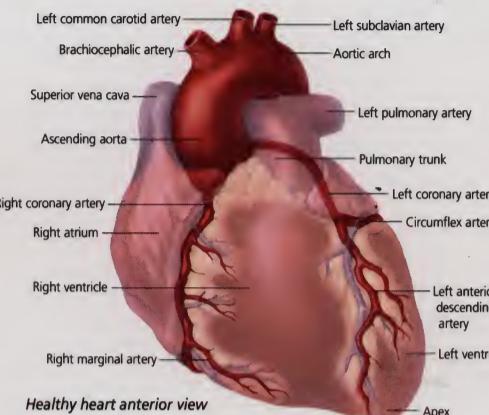
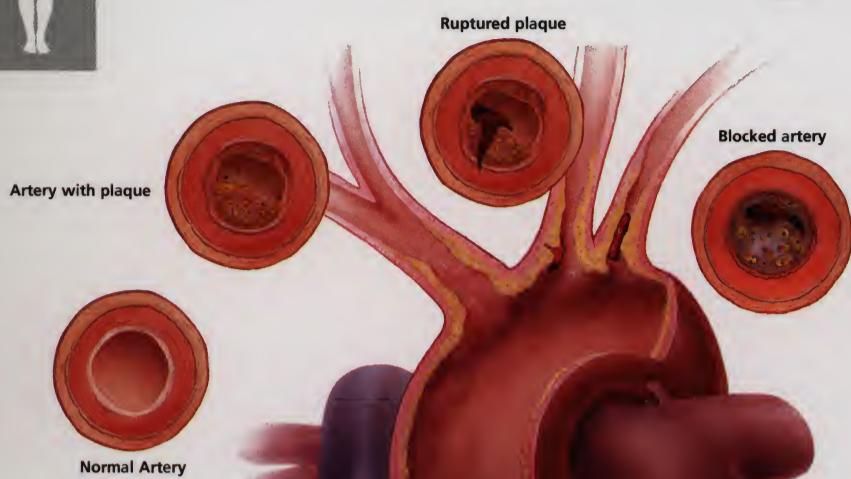
Antiplatelets decrease the ability of the blood to clot. Examples are aspirin, Heparin and IIb/IIIa.

Sympathetic nervous system blocking drugs cause the heart to slow down and beat less forcefully. They also decrease constriction of arteries throughout the body. Examples are alpha, beta and adrenergic blockers.

Vasodilators act directly on blood vessel walls or through other mechanisms to increase blood vessel diameter. Examples are calcium channel blockers, and nitroglycerin.



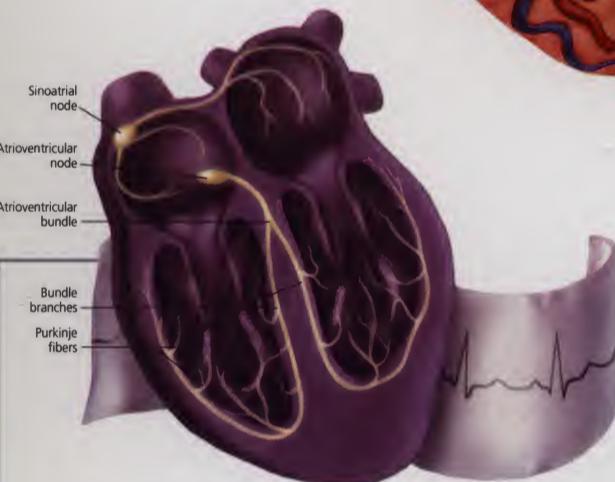
Understanding Heart Disease



Angina Warning Symptoms

Chest pain or pressure that is not usually localized and commonly follows physical exertion or stress:

- Squeezing, tightness, burning, or aching sensations
- Often located under or to the left of the breastbone
- Similar sensation to indigestion or gas
- Typically short in duration, 1 to 15 minutes
- Radiating to shoulder, arm, jaw, neck, or other areas

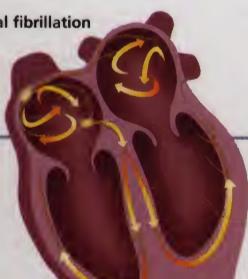


Rhythmic Disturbances

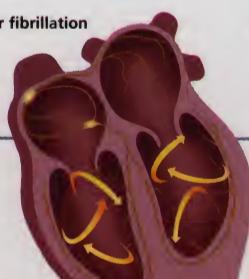
The normal heart: The heart's rhythmic contractions are regulated by electrical impulses that originate in the **sinoatrial node**, travel across the upper chambers of the heart (atria) to stimulate a contraction, then travel to the **atrioventricular node**. After a pause, the impulses travel along conducting fibers to stimulate ventricular contractions.

Abnormal heart rhythms: Many conditions can disturb the heart's normal electrical rhythms. **Tachycardia** (over 100 beats per minute) and **bradycardia** (under 60 beats per minute) are common **arrhythmias**. In coronary artery disease, lack of blood flow often creates arrhythmias as well as conduction blocks. Scar tissue from heart attack can also trigger serious rhythmic disturbances.

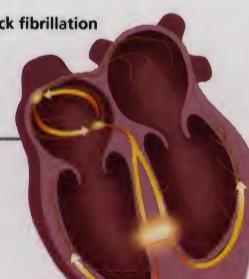
Atrial fibrillation



Ventricular fibrillation



Heart block fibrillation



Arrhythmia Warning Symptoms

Signs of a rhythmic disturbance may include palpitations, often described as fluttering in the chest (usually not serious unless multiple beats are skipped in succession). Other signs include pounding or racing heartbeat not related to exercise; repeated episodes of light headedness or dizziness; sudden fainting spells; and cardiac collapse, a life-threatening condition.

Causes of Coronary Artery Disease

The disease processes that lead to CAD have been attributed to many different causes. They include **genetic**, **age**, and **gender** factors as well as **lifestyle** or **modifiable risks**.

- High blood pressure
- Smoking
- High cholesterol
- Obesity
- Diabetes
- Inactive lifestyle
- Stress

A higher number of risk factors increases your chances of developing CAD.

Healthy Lifestyle Changes

By following recommended lifestyle changes, many risk factors for heart disease can be significantly reduced or controlled. Seeking treatment for **hypertension**, lowering cholesterol through diet and medication, quitting **smoking**, increasing **physical activity**, managing **diabetes**, and **losing weight** are all important steps to a healthier heart.

Blood Supply and the Heart

The heart is a powerful muscle that depends on a continuous flow of oxygen and nutrients. This blood supply is provided by **coronary arteries**, which originate from the aorta and branch out to deliver oxygenated blood throughout the **myocardium**, the muscular layer of the heart wall.

How Heart Disease Develops

Over time, the walls of the coronary arteries can become narrowed by a gradual buildup of fat and cholesterol deposits called **plaque**. This process, **atherosclerosis**, reduces the interior diameter of the arteries and restricts blood flow to the heart muscle, starving it of vital oxygen and nutrients. The resulting condition is **coronary artery disease (CAD)**. Three major complications of coronary artery disease are **angina**, **heart attack**, and **congestive heart failure**.

What is Angina?

There are two primary types of **angina**, a painful condition caused by reduced oxygen flow to the muscle fibers in the heart.

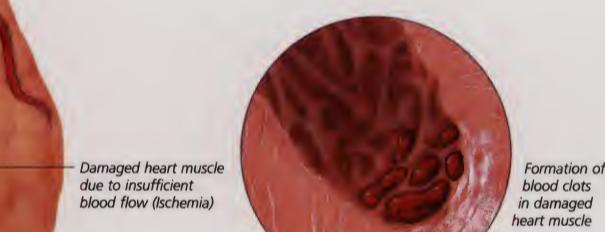
Angina pectoris is characterized by sudden, brief attacks of chest pain, often triggered by exercise and other strenuous or stressful activities.

The pain usually subsides when the activity ceases or after a period of rest.

Unstable angina is associated with longer or more severe attacks of chest pain. Key warning signs are changing patterns of chest pain or decreased activity preceding the pain. Unstable angina can lead to a heart attack.

What is a Heart Attack?

Also known as **myocardial infarction**, a heart attack occurs when a coronary artery is suddenly blocked by a blood clot. Deprived of oxygen, the affected area of the heart muscle dies. A heart attack immediately reduces the heart's pumping ability and may lead to **cardiac arrhythmias** and **cardiac arrest** (a complete stoppage of the heart). The severity of the attack is determined by the amount of heart muscle damage and the function of nearby arteries.



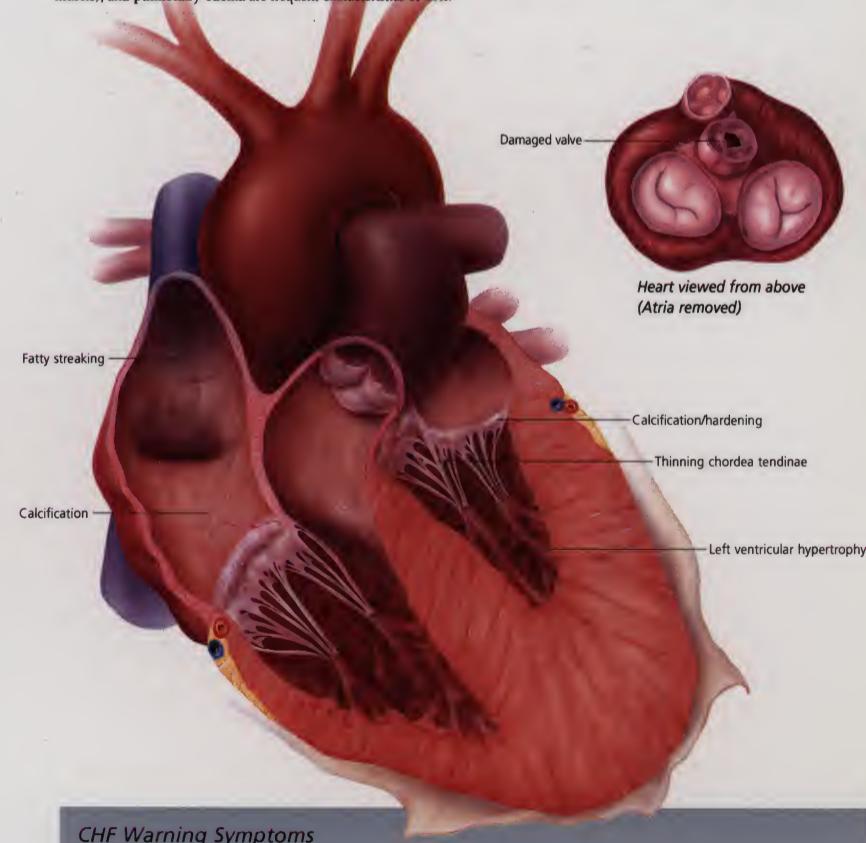
Heart Attack Warning Symptoms

Pain, tightness, or sensations of fullness or squeezing in the chest that occur suddenly and last several minutes or more:

- Chest pain radiating to the jaw, shoulder, or arm
- Shortness of breath
- Nausea and sweating
- Pale, clammy skin
- Weakness and light headed

What is Congestive Heart Failure?

Congestive heart failure (CHF), also known simply as **heart failure**, is a condition in which the heart has become weak and can no longer pump blood efficiently or provide adequate oxygen for the brain and other organs. Causes of CHF include CAD and high blood pressure as well as congenital heart disease and valve disease. Enlarged heart, **hypertrophy** (thickening of the heart muscle), and **pulmonary edema** are frequent characteristics of CHF.



CHF Warning Symptoms

The most common signs of congestive heart failure include:

- Shortness of breath during regular activity (dyspnea)
- Frequent coughing
- Nausea and loss of appetite
- Increased heart rate
- Difficulty breathing while resting or sleeping
- Fluid buildup in feet, ankles, or legs (edema)
- Impaired thinking and confusion
- General fatigue



Understanding Stroke

What is stroke?

A stroke is a cerebral vascular accident that occurs when blood flow to the brain is suddenly interrupted by a burst blood vessel or a blockage in the brain's blood supply. Nerve cells in the affected part of the brain no longer receive oxygen and nutrients, and the result is temporary or permanent loss of function in the corresponding parts of the body.

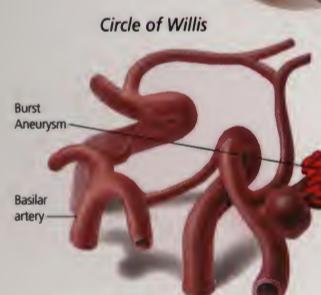
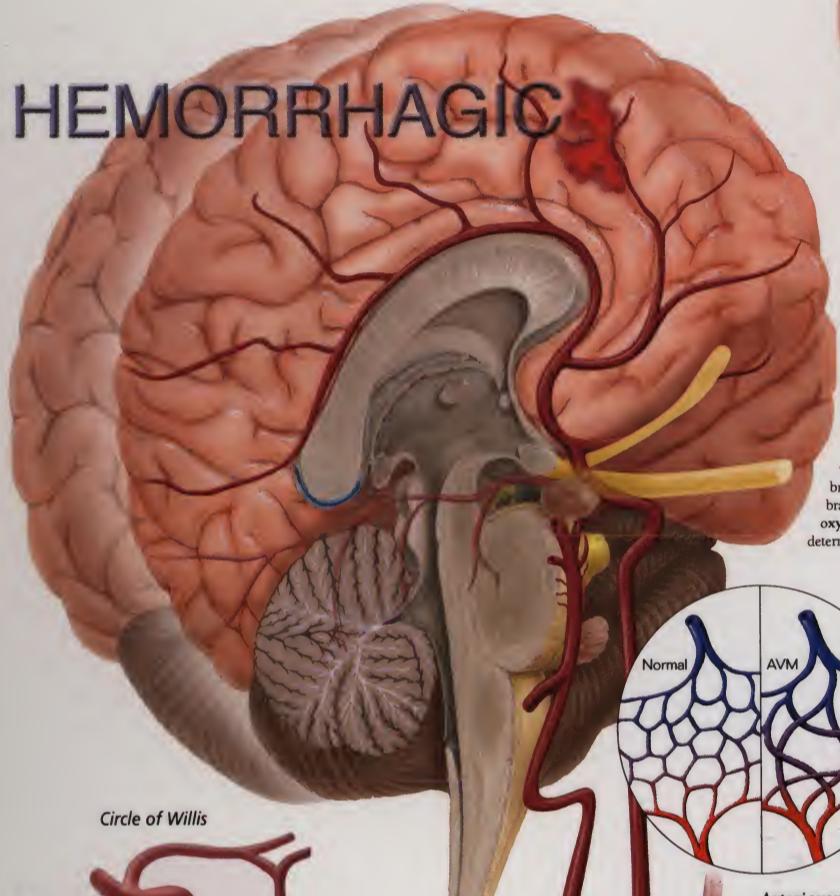
Strokes are classified into two major categories:

- Ischemic stroke is the most common type, occurring in approximately 80 percent of all cases
- Hemorrhagic stroke is present in about 20 percent of stroke cases

What are the causes of stroke?

Every type of stroke has a specific physiological cause. In general, however, strokes are frequently caused by underlying medical conditions such as high blood pressure, heart disease, or atherosclerosis (narrowing of the arteries). Strokes may also be the result of head injuries, aneurysms, or congenital defects in the arteries of the brain.

HEMORRHAGIC



Subarachnoid
A ruptured blood vessel on the surface of the brain bleeds into the space between the skull and the brain.

As the vessel weakens, warning signs such as sudden headaches and light sensitivity may be present for days or weeks.



Arteriovenous malformation (AVM)

A rupture occurs within a cluster of abnormally formed blood vessels in the brain.

Symptoms may include migraine-like headache, numbness, muscle weakness, and seizures.

Intracerebral

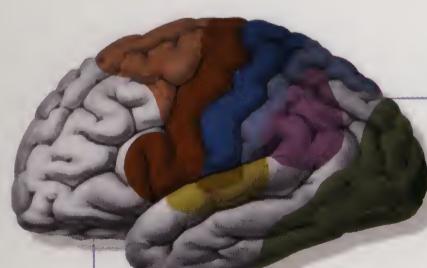
Blood from a ruptured artery in the brain is released into surrounding brain tissue.

The symptoms usually occur suddenly and can include headache, nausea, and marked changes in mental state.

Cerebrovascular insufficiency

A series of mini-strokes occurs in the smaller vessels of the brain. Tiny arterioles bulge, then burst from high pressure or become blocked by small blood clots.

There are no symptoms until damage accumulates over time.



Effects of Strokes

Three factors influence the effects of a stroke:

- What type of stroke was it?
- Where did the stroke occur?
- How much injury was caused?

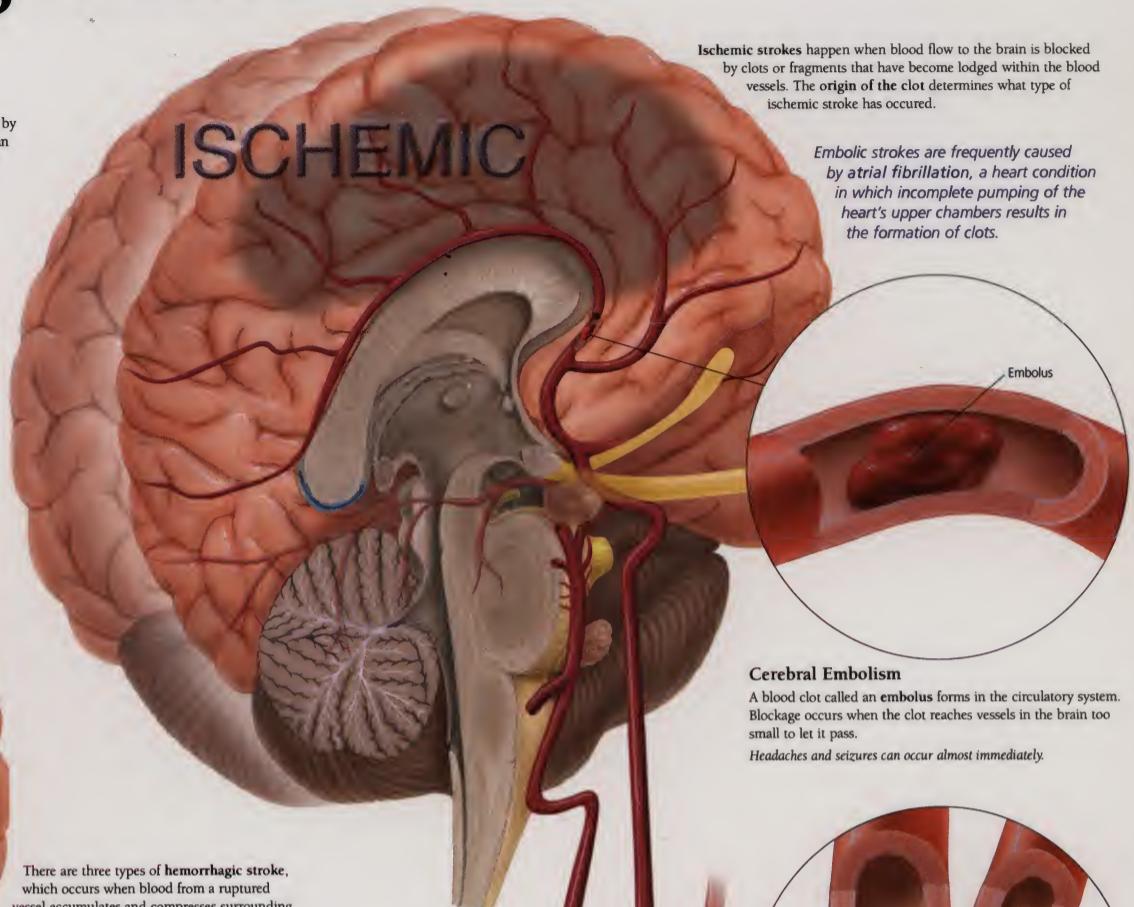
The location of the stroke is especially critical in understanding which parts of the body will be most affected. A stroke near the back of the brain will often cause changes in vision. A stroke on the right side of the brain will affect neurological function on the left (opposite) side of the body.

Right brain strokes may cause:

- Paralysis of the left arm, leg, and side of face
- Loss or impairment of analytical skills
- Problems with spatial perception
- Sudden, impulsive behavior
- Short-term memory loss

Left brain strokes may cause:

- Paralysis of the right arm, leg, and side of face
- Difficulty speaking or understanding language (aphasia)
- Slow and cautious behavior
- Difficulty with conceptual thinking
- Memory loss and difficulty learning new tasks



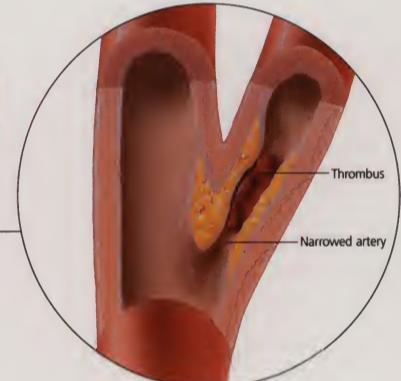
Ischemic strokes happen when blood flow to the brain is blocked by clots or fragments that have become lodged within the blood vessels. The origin of the clot determines what type of ischemic stroke has occurred.

Embolic strokes are frequently caused by **atrial fibrillation**, a heart condition in which incomplete pumping of the heart's upper chambers results in the formation of clots.

Cerebral Embolism

A blood clot called an **embolus** forms in the circulatory system. Blockage occurs when the clot reaches vessels in the brain too small to let it pass.

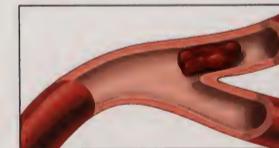
Headaches and seizures can occur almost immediately.



Cerebral Thrombosis

A blood clot or **thrombus** forms within an artery supplying blood to the brain. The most common type of stroke, thrombosis often results from damage to the arteries caused by fatty deposit buildups (atherosclerosis).

Symptoms such as loss of feeling, speech problems and seizures may occur gradually, over a period of minutes or hours.



Transient Ischemic Attack (TIA)

A temporary blockage of blood flow to the brain is caused by small emboli that break up and dissolve shortly after lodging in vessel walls.

Mild stroke-like symptoms can last for minutes or up to 24 hours.

Symptoms lasting over 24 hours are considered a stroke. TIAs are often warning signs of future ischemic stroke and should be treated immediately.

Stroke Symptoms

Most strokes share these warning signs and symptoms:

- Sudden or severe headache
- Dizziness or loss of balance
- Double vision or blurring in one or both eyes
- Difficulty in swallowing
- Weakness or numbness on one side of the body
- Difficult speaking or understanding others
- Confusion or difficulty thinking
- Sudden loss of bowel or bladder control

Call 911 immediately for help if you or someone you know experiences any of these symptoms of stroke.

Stroke Rehabilitation

The time it takes to recover from a stroke and the amount of recovery possible depend on the amount of damage that occurred to the brain.

Regardless of the type of stroke, early intervention and treatment—within a few hours of the onset of the stroke—are critical in possibly preventing further brain injury and promoting long-term recovery.

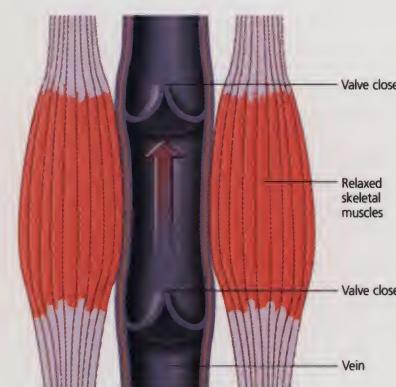
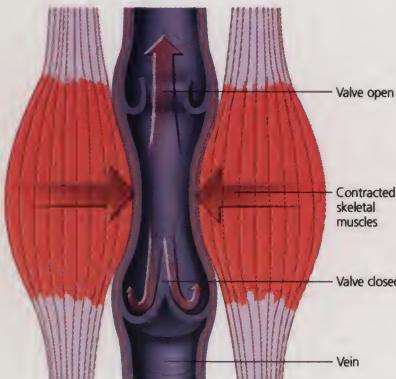
- Diagnostic tests such as CT scans and MRI are used to determine the nature and extent of the stroke.
- Stroke rehabilitation can include physical, speech, and occupational therapies.
- Recovery usually begins within the first few weeks and speech and function may continue to improve gradually for a year or more after the stroke.



Understanding DVT Deep Vein Thrombosis

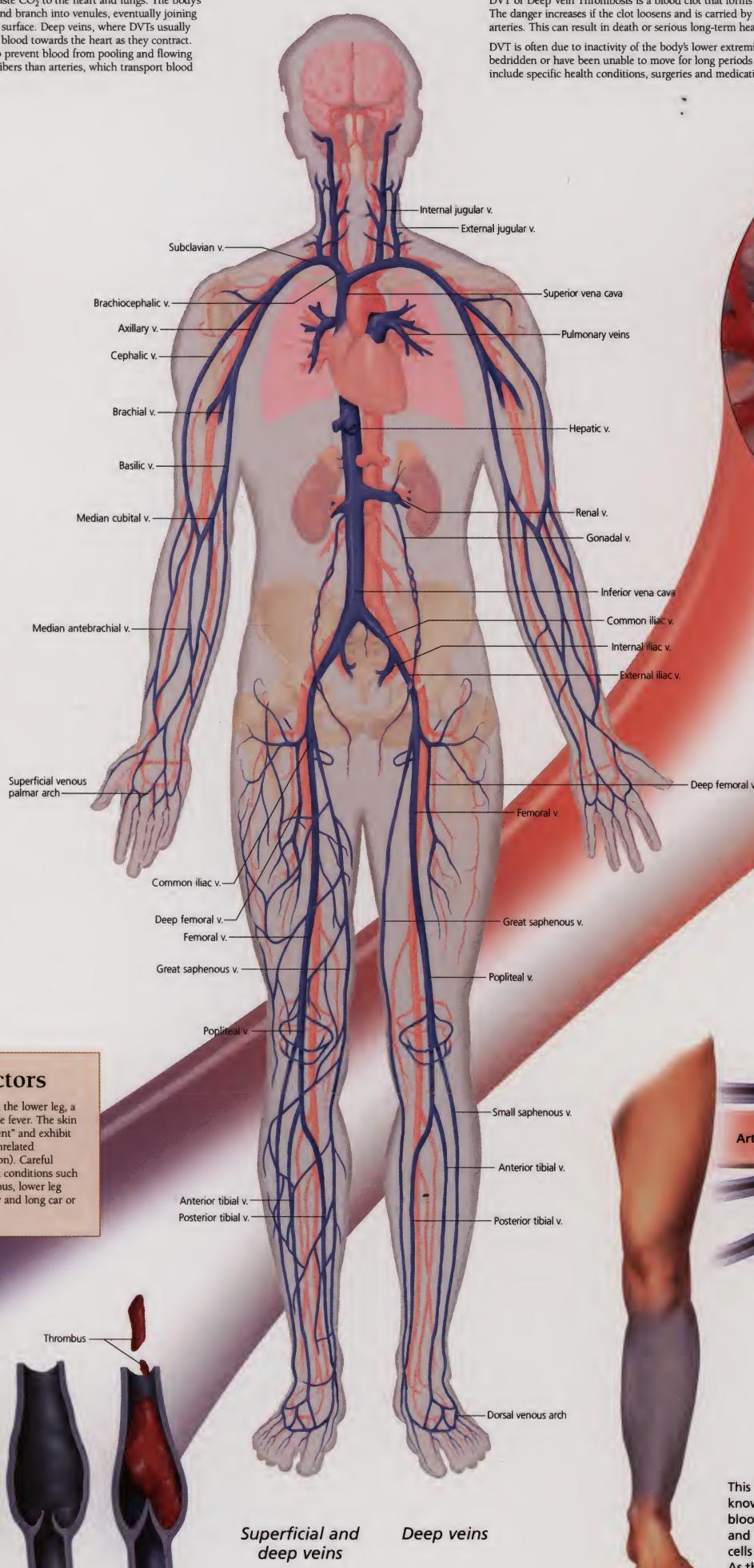
What is the Venous System?

The venous system returns deoxygenated blood and waste CO_2 to the heart and lungs. The body's veins originate as capillaries in the organs and tissues and branch into venules, eventually joining to become veins. Superficial veins lie closer to the skin surface. Deep veins, where DVTs usually occur, are surrounded by muscles, which help to push blood towards the heart as they contract. These larger veins also contain many one-way valves to prevent blood from pooling and flowing backwards. Veins have thinner walls and fewer elastic fibers than arteries, which transport blood from the heart under significantly higher pressures.



How valves work

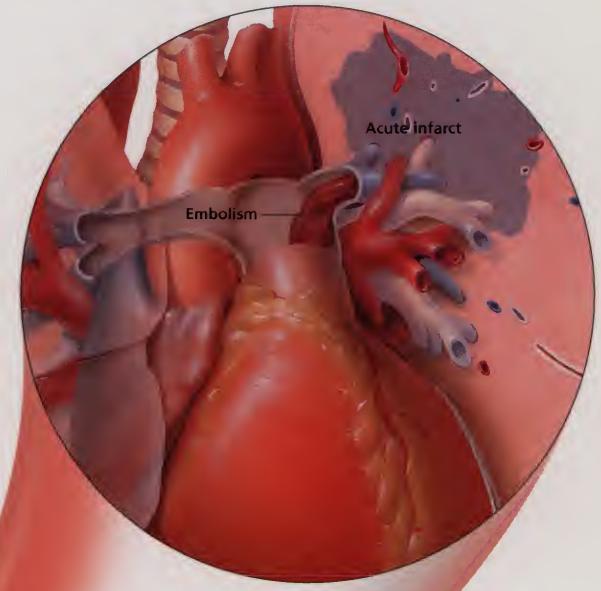
Valves inside the veins open to allow blood to flow towards the heart and close to prevent it from flowing backwards. In the diagram below, skeletal muscles surrounding the veins contract and compress the vein. As the upper valve opens, the lower valve remains closed, forcing the blood upward. When the muscle relaxes, the upper valve closes to prevent blood from flowing back.



What is DVT?

DVT or Deep Vein Thrombosis is a blood clot that forms in a deep vein of the body, most commonly in the legs. The danger increases if the clot loosens and is carried by the blood to the lungs, causing a blockage in the lung arteries. This can result in death or serious long-term health complications.

DVT is often due to inactivity of the body's lower extremities. Most commonly, it develops in those who are bedridden or have been unable to move for long periods of time, such as during an overseas flight. Other risks include specific health conditions, surgeries and medications.



What is a Pulmonary Embolism?

Pulmonary Embolisms occur when foreign material, frequently a blood clot, lodges in an artery in the lungs. Blood flow is slowed or stopped causing sharp, sudden chest pain that becomes more severe when taking a deep breath. The illustration (above) indicates an embolism, occurring in the left pulmonary artery with acute infarct (a sudden insufficiency in the blood supply).

DVT Symptoms and Risk Factors

Initial symptoms of DVT can include swelling, pain, and warmth in the lower leg, a mild cramping sensation, swollen subcutaneous veins and low grade fever. The skin may also have a bluish discoloration. However, many DVTs are "silent" and exhibit few or no symptoms. DVT-like symptoms may also be caused by unrelated conditions, including muscle strains and phlebitis (vein inflammation). Careful clinical evaluation is required. Risk factors for DVT include medical conditions such as previous DVT, stroke or heart attack, congestive heart failure, lupus, lower leg fractures, and recent major surgery. Extended periods of immobility and long car or plane trips also increase risk.

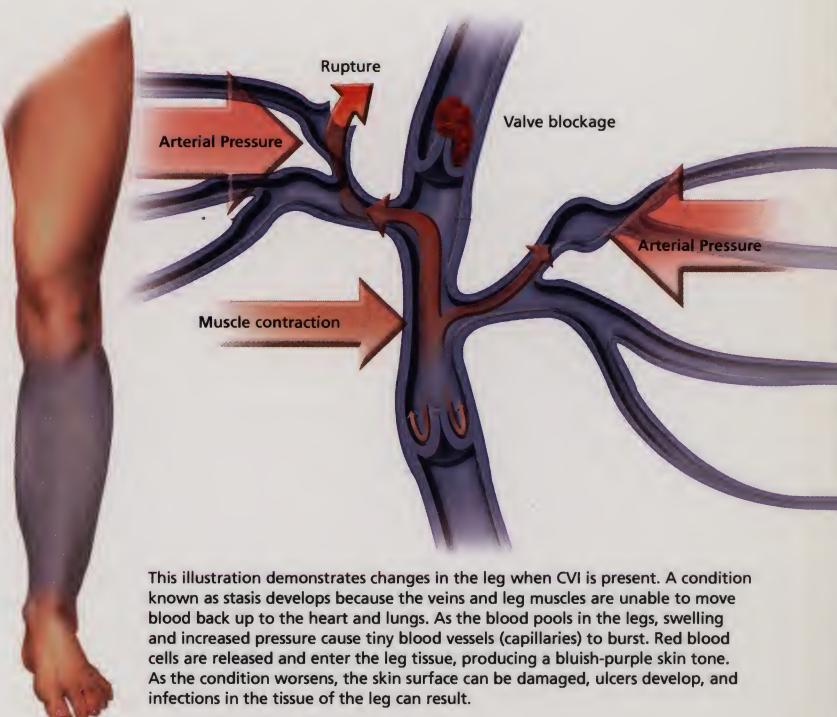


The formation of blood clots

The series of one-way valves are engineered to allow blood to flow up the leg against gravity. The cross-section illustrations reveal two cusps, which create the two cup-like areas of the valve at risk of pooling blood. The first illustration of the series (1) indicates the normal valve closure. The following two illustrations (2,3) indicate how pooling can start and then build, creating a clot. The next two illustrations (4,5) indicate a complete blockage and irreversible damage to the valve, effective valve closure is compromised and reverse blood flow is possible. A serious condition can result when a section of a blood clot called a thrombus (6) breaks off and travels to the lungs causing an embolism.

Taking Control of your DVT

For those that are susceptible to DVT, there are means to limit incidents. Exercising the legs will do the most to reduce the risk of DVT, because it will help keep blood from pooling in the leg veins. If this is not possible, keep the legs elevated when sitting. If the patient is not self-sufficient, aid should be provided to guide the patient's legs through their normal range of motion. A lower leg massage is also beneficial. There are special elastic leg stockings that should be worn. They should be changed once a day to insure no chafing or leg discoloration has occurred.



This illustration demonstrates changes in the leg when CVI is present. A condition known as stasis develops because the veins and leg muscles are unable to move blood back up to the heart and lungs. As the blood pools in the legs, swelling and increased pressure cause tiny blood vessels (capillaries) to burst. Red blood cells are released and enter the leg tissue, producing a bluish-purple skin tone. As the condition worsens, the skin surface can be damaged, ulcers develop, and infections in the tissue of the leg can result.

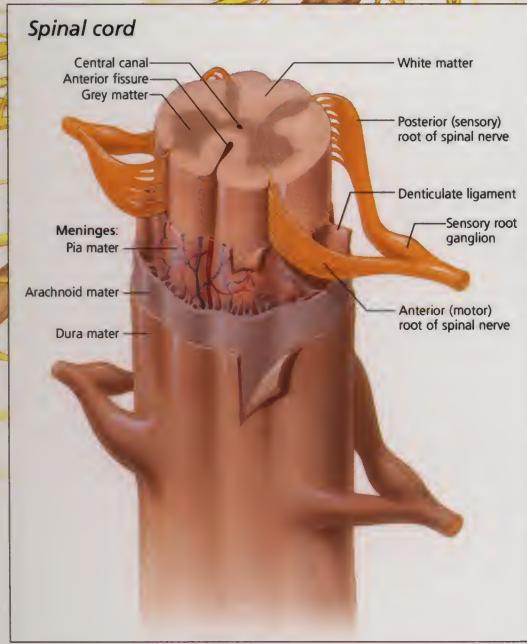
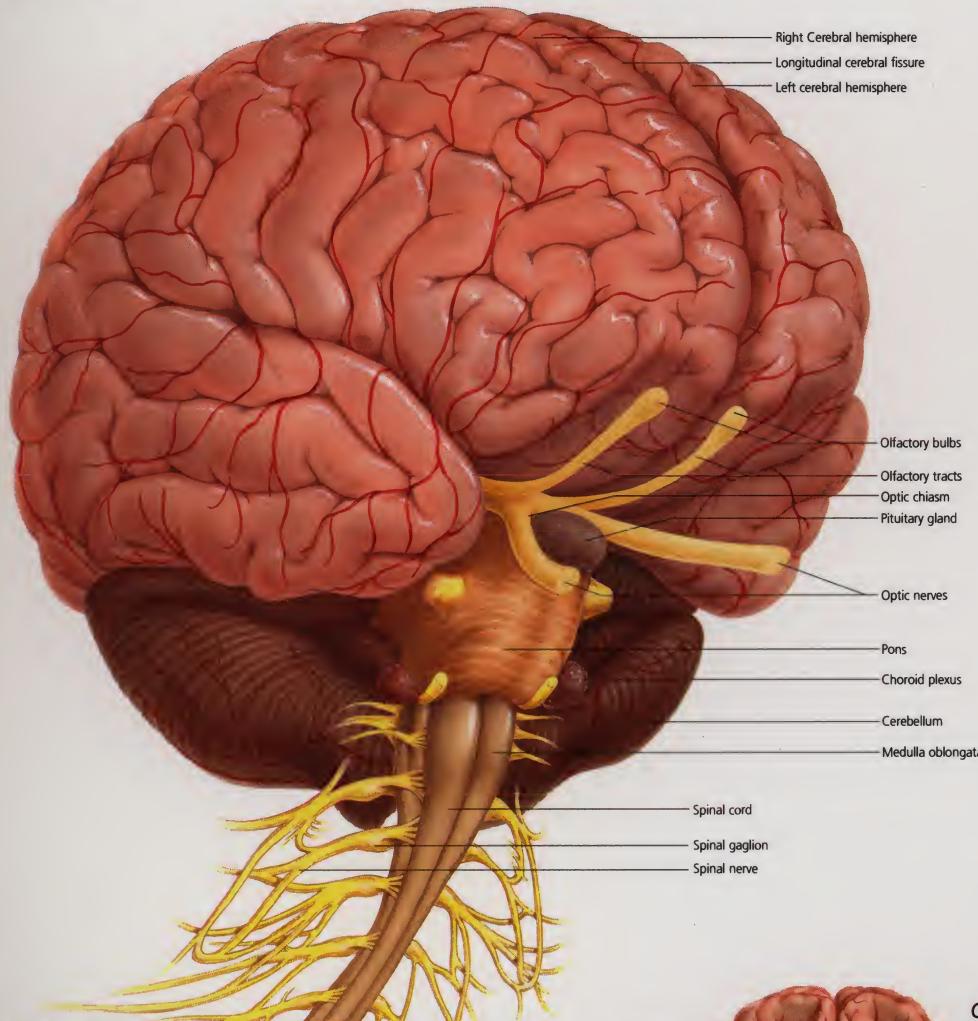
Diagnosis and Treatment of DVT

When suspicious symptoms are reported, there are several ways to determine if DVT is present. Blood pressure can be checked at various places on the leg, a process called impedance plethysmography (IPG). Also, high frequency sound waves, or ultrasound, can be used to create images of the leg. X-rays can be also taken of the leg following the injection of a dye-like substance into the veins to highlight blood flow. The standard treatments for DVT typically include blood thinners or anti-coagulants used on a short- or long-term basis.



Understanding CNS

Central Nervous System



The spinal cord and nerves

The spinal cord connects the peripheral nervous system to the brain, coordinates simple reflexes to stimuli, and helps regulate the internal organs. It contains 31 pairs of spinal nerves, which include both sensory and motor axons. Nerve signals generated by the sensory neurons travel through the spinal cord to the brain. Signals from the motor areas of the brain are sent back through the cord and directed to the motor neurons, triggering a response.

The inner core of the spinal cord is gray matter composed of neuron cells, glial cells, and interneurons. The outer core or white matter is made up of tracts of myelinated axons responsible for transporting nerve signals. Surrounding the spinal cord are the meninges, protective bones of the vertebral column and a cushioning layer of fat and connective tissue in the epidural space.

Neurological disorders

Changes in the normal function of the brain, spinal cord, or the nerves connected to the CNS may be caused by physical trauma, biochemical imbalances, or a variety of other factors. Research and advanced diagnostic techniques are providing new clues into the origin and treatment of many neurological disorders.

Parkinson's disease

- Initiated by degeneration of the area of the brain that produces the neurotransmitter dopamine, which regulates motor activity
- Decreasing supplies of dopamine result in progressive weakness, muscle stiffness, tremors, and difficulty with posture, balance, motion, and speech

Depression

- Symptoms may include loss of appetite and interest in activities, sleep disorders, agitation, low energy, and difficulty concentrating
- Linked to abnormal delivery of neurotransmitters, particularly serotonin, acetylcholine, and catecholamines such as adrenaline; also to hormonal imbalances

Epilepsy

- Abnormal electric discharges in the brain and excessive neuron stimulation trigger loss of consciousness and convulsions
- May result from trauma, oxygen deprivation, or infection; in isolated cases, from low blood sugar or other imbalances
- Cause is unknown in approximately 50% of cases

Bacterial meningitis

- A dangerous inflammation and infection of the meninges, the protective membranes covering the brain and spinal cord
- Caused by bacteria transported through the blood; may also result from an ear or sinus infection or skull fracture
- Symptoms include high fever, chills, headache, stiff neck, nausea, confusion or coma; immediate treatment is required

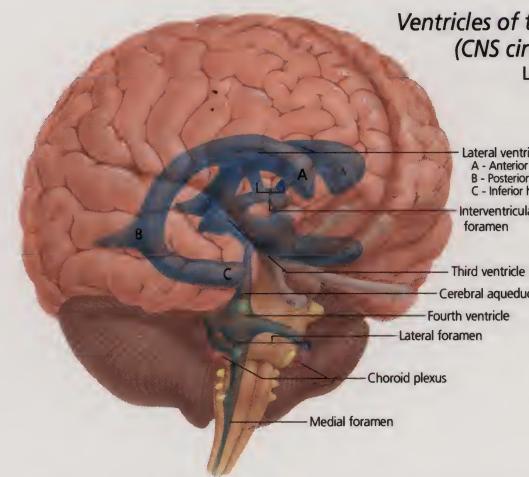
Alzheimer's Disease

- A degenerative condition that gradually destroys nerve cells in the cerebral cortex, impairing movement, cognition, and memory
- May be influenced by both genetic and environmental risk factors
- Disease process has been linked to impaired flow of nutrients to neurons; reduced levels of the neurotransmitter acetylcholine; and accumulation of an insoluble protein called beta amyloid, which interferes with normal nerve signals and function



Functional Areas of the Brain
Primary visual area
Primary motor area
Secondary motor area
Primary somatosensory area
Secondary acoustic area
Sensory speech

Ventricles of the brain (CNS circulation)
Lateral view



What is cerebrospinal fluid?

Cerebrospinal fluid (CSF) is mainly secreted by the choroid plexuses of the ventricles of the brain. CSF flows in the ventricles, central canal and subarachnoid space and also acts as a shock absorber. CSF plays many other important roles in the CNS, supplying nutrients to the neurons and glial cells, transporting active biochemicals such as neurotransmitters and hormones, and removing waste products.

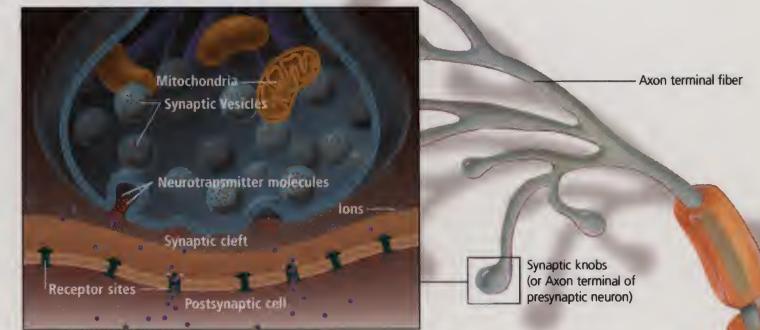
What is the central nervous system?

The nervous system is composed of two integrated systems that are responsible for conducting and processing sensory and motor information: the central nervous system (CNS) and the peripheral nervous system (PNS), which connects the CNS to the rest of the body.

The CNS includes the brain and spinal cord, which are covered by protective membranes called meninges (dura mater, arachnoid, and pia mater). The brain processes and coordinates all neural signals received from the spinal cord as well as its own nerves, such as the olfactory and optic nerves, and performs complex mental functions such as thinking and learning. The peripheral nervous system transmits input gathered from the sensory organs to the CNS. Motor output signals are relayed back to the PNS and on to the body's muscles and glands. The PNS has three separate divisions called the autonomic, sensory, and motor nervous systems.

The functional units of the nervous system are neurons. Sensory neurons communicate information from sensory receptors to the CNS. Motor neurons relay signals from the CNS to effector (muscle and gland) cells. Interneurons fill in the spaces between neurons. Glial cells also make up a significant portion of the nervous system and provide important support for neuron activity.

Synaptic knob or axon terminal of presynaptic neuron



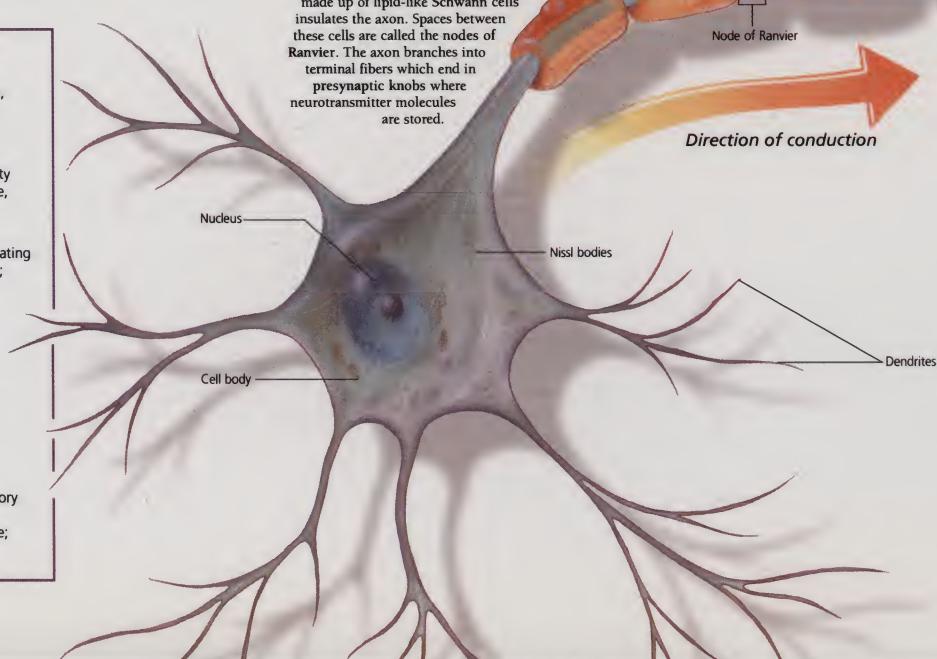
What are synaptic connections?

Neurons in the CNS create thousands of input and output connections with other neurons, forming dense networks within the brain. Fiber-like structures called dendrites extend from the membrane of each neuron to receive and transmit signals from other neurons into the cell body. A long, tube-like extension called the axon sends signals from the neuron towards nearby target cells. As impulses arrive at the tip of the axon, the terminal bulb releases "messenger" molecules called neurotransmitters. These highly specialized chemicals carry nerve impulses across the tiny space between the axon and the adjacent neurons or cells, either inhibiting or activating neural impulses in the target cell.

Every neurotransmitter (i.e., dopamine and serotonin) has unique characteristics that allow it to bind to specific receptor sites on target cells. However, not all neurotransmitters are absorbed or used by target cells. Neurotransmitter molecules in the synaptic gap may be neutralized by enzyme degradation or reabsorbed back into the axon terminal in a process called reuptake, which blocks the neurotransmitter's potential action.

Structure of the motor neurons

Motor neurons transmit impulses to other cells, specifically muscle fibers or glands. Each neuron consists of a central cell body with a nucleus and numerous fiber-like extensions called dendrites that collect and relay information to the cell body for processing. Nerve signals directed from the cell body travel towards target cells via the axon, a long extension of the cell membrane. An insulating myelin sheath made up of lipid-like Schwann cells insulates the axon. Spaces between these cells are called the nodes of Ranvier. The axon branches into terminal fibers which end in presynaptic knobs where neurotransmitter molecules are stored.





Understanding Diabetes

Glucose Metabolism

After a meal, carbohydrates are converted to glucose by the digestive system. The glucose then enters the bloodstream. The pancreas responds to the rise in the blood glucose level by producing insulin and secreting it into the bloodstream. Insulin has several effects—it suppresses glucose production in the liver, it signals the liver to increase glucose uptake, and it allows glucose to enter cells from the bloodstream. As a result of these actions, blood glucose levels fall, insulin production ceases, and homeostasis is restored.

When blood glucose level drops too far (such as after skipping a meal), the pancreas produces glucagon and secretes it into the bloodstream. Glucagon signals the liver to change glycogen into glucose and to release the glucose into the bloodstream. As blood glucose levels rise, glucagon production ceases, and homeostasis is restored.

Glucagon signals the liver to convert glycogen to glucose and release the glucose into the blood

Glucose

Insulin stimulates cells to take up glucose

Insulin

Blood Glucose Level

Glucagon
Epinephrine/Cortisol
Human Growth Hormone

Cells use glucose as fuel

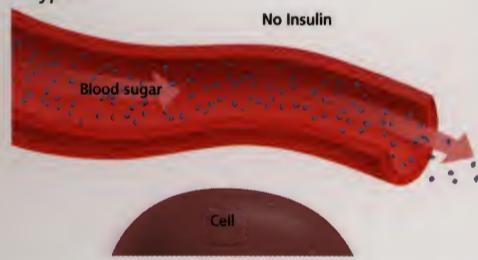
Glucose is converted to triglycerides and stored in fat (adipose tissues)

Function of Insulin

Insulin, which is produced by the pancreas, facilitates the absorption of glucose into muscles for fuel. Glucose provides power to the body, but is kept under control by insulin. When the body acts normally, insulin bonds to the surface of cells and, as glucose travels throughout the body, glucose is able to penetrate the cell and be used effectively. Insulin determines how much glucose is produced by the liver and between meals. It does this by countering another hormone, glucagon, also produced by the pancreas. Glucagon sends a message to the liver to convert glycogen to glucose.

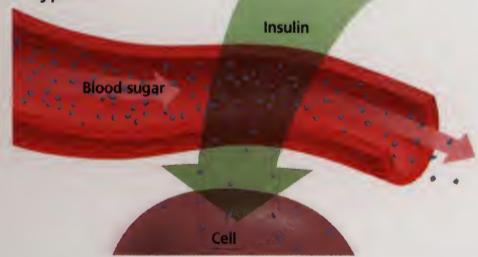
Action of Insulin

Type I



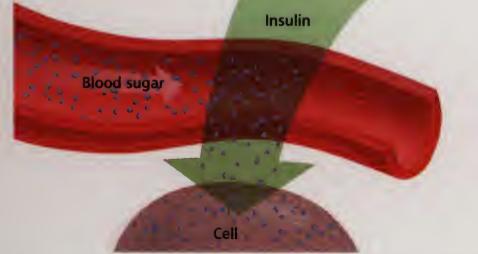
Type I diabetes is less prevalent and occurs when there is a complete failure of the pancreas to produce insulin. It is considered an autoimmune disease. Type I diabetes occurs when antibodies produced by the body attack beta cells, which secrete insulin, are damaged over time and the cells eventually cease to produce the needed insulin. The absence of insulin allows ketones, normally a beneficial substance produced by the liver, to build up to abnormal levels causing an acidosis (diabetic) coma.

Type II



Type II diabetes occurs when the body resists the effects of insulin, or when there is a partial failure of the pancreas to produce insulin. Overweight people are often afflicted with this type of diabetes because their tissue becomes unable to respond to insulin and the pancreas is forced to produce more, but cannot meet the demand. The lack of insulin prevents glucose from entering the cells, so the body is not fully energized. This type of diabetes is normally diagnosed later in life as the continual strain on the pancreas leads to a decline of insulin production.

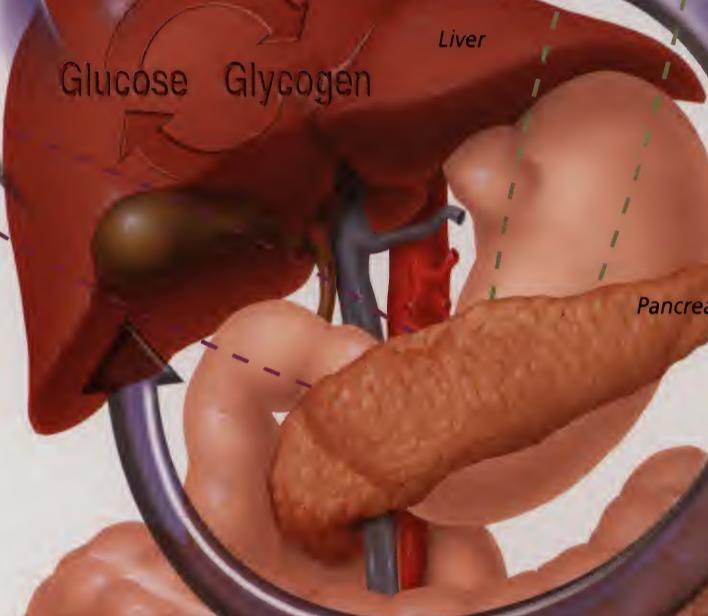
Normal



The interaction of glucose and insulin maintain a normal level of blood sugar and enable the body to perform daily activities.

What Is Diabetes?

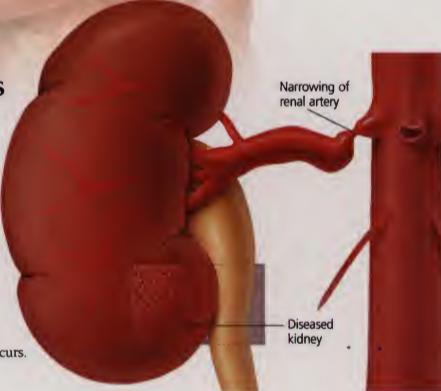
Diabetes is a disease characterized by a chronic imbalance in the blood glucose levels. There are two primary types of diabetes. Diabetes can strike at any age, although historically, young people normally fall victim because insulin production completely ceases. Those afflicted at later ages have some insulin production, but not enough to maintain a healthy blood glucose level. There are also two lesser known types of diabetes. One affects women during pregnancy and is termed "gestational diabetes." It most often disappears or subsides substantially after the pregnancy ends. The fourth type of diabetes is the result of pancreatic disease, hormonal irregularities, or harmful drug interaction.



Health Complications

Kidney damage

The kidney's ability to filter waste from the bloodstream is hindered by diabetes. High glucose levels, plus the common side effect of high blood pressure, damage the group of capillaries within the kidney called the glomeruli. A normal kidney filters waste and discharges it through the urine, allowing the necessary proteins to flow back through the body. Kidney damage, termed "nephropathy," is irreversible, leaving dialysis or a kidney transplant as the only two means to replace vital kidney processes once complete kidney failure occurs.

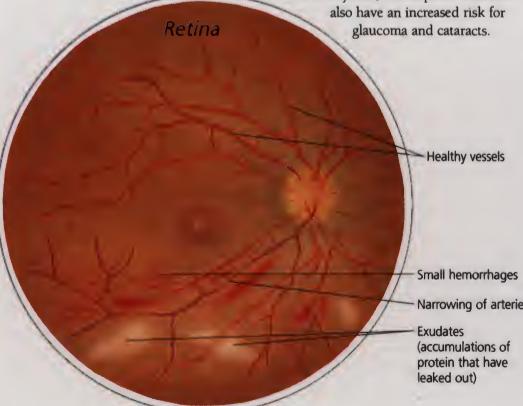


Symptoms of Diabetes

- Increased frequency of urination
- Unusually high desire for fluids
- Weight loss
- Blurred vision
- Weakness and fatigue
- Skin infections
- Complications that may include vascular disease and nerve damage

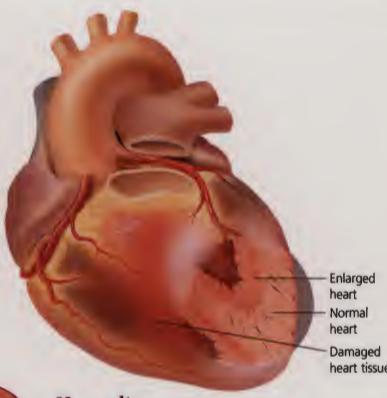
Vision problems

Vision problems are a common side effect of diabetes, specifically a condition known as retinopathy. In this eye complication, the small blood vessels that supply the retina with blood weaken and leak, damaging the retina and hindering its ability to transmit images to the brain. A more severe condition arises when fragile blood vessels grow into the vitreous humor (a jelly-like substance at the back of the eyeball) and rupture. Diabetics also have an increased risk for glaucoma and cataracts.



Nerve damage

Diabetics' higher glucose levels make them more susceptible to nerve damage. The most common form is peripheral neuropathy, which causes limbs to tingle as a result of the reduced function of sensory nerves. Peripheral neuropathy develops slowly and creates numbness and pain in the hands and legs. Other forms of nerve damage may also affect the digestive tract, bladder, and other internal organs.



Heart disease

Atherosclerosis, or narrowing of the arteries, may cause circulation to deteriorate in the coronary arteries. This leads to an increased possibility of angina, pain caused by a reduced blood flow to the heart, or heart attack. Strokes are also more prevalent in diabetics, as arteries to the brain are also affected by reduced blood flow.

Treatment and Healthy Lifestyle changes

Proper diabetes control depends on glucose levels. When glucose levels are too low, diabetics occasionally experience hypoglycemia, or low blood sugar. Hypoglycemia typically occurs when the insulin dosage exceeds the amount needed, such as between meals. The opposite condition is hyperglycemia, resulting when the body is not able to burn off sugars through physical activity. Both conditions occur often in diabetics because glucose levels controlled through medication cannot be as precisely regulated as through the body's natural mechanisms.

The successful treatment for diabetes, a non-curable disease, requires that patients maintain a healthy lifestyle through diet, medication, and exercise. Here are a few suggestions:

- 1) Monitor blood glucose levels. Seek the advice of a doctor or nurse as to the type (blood or urine) and the frequency of tests required.
- 2) Eat regularly and do not skip meals. This advice is very important to maintain proper blood glucose levels. The amount of food eaten must be balanced with the amount of energy expended. If the patient is taking insulin, regular consultation with a dietitian or nurse is recommended to help coordinate the timing of injections with meals.
- 3) Choose the right foods. Balance starchy, high fiber foods with vegetables, fruits, and proteins. Avoid sweets and high-fat foods. Limit salt intake.
- 4) Limit or avoid alcohol. For patients on medication, whether orally or by injection, alcohol can lead to a hypoglycemic attack.
- 5) Exercise regularly.
- 6) Maintain ideal body weight. Lose weight if necessary by eating a well-balanced diet. Avoid fad diets.
- 7) Take medication as prescribed.



Understanding Cholesterol

What is cholesterol?

Cholesterol is a natural, fat-like substance that is indispensable to the human body. It is a key component of cells, helping to maintain the stability and fluidity of cell membranes. It is utilized abundantly in the liver to produce cholic acid, which forms the bile salts necessary for fat digestion. Cholesterol is also necessary for the formation of hormones such as estrogen and testosterone. Significant amounts of cholesterol are used in the skin to synthesize Vitamin D and to help control water evaporation through the pores.

The body's cholesterol supply comes from two sources. It is primarily manufactured in the liver, along with several other organs in the body. It is also ingested through food, particularly eggs, red meat, and dairy products high in cholesterol content.

What does "high cholesterol" mean?

Blood cholesterol tests measure the amount of cholesterol bound to **lipoproteins**, fat-protein complexes that carry fats through the bloodstream. A diagnosis of high cholesterol or **hypercholesterolemia** indicates total cholesterol levels of 240 mg/dL or above (see chart below). More specifically, it indicates unhealthy levels of **low-density lipoproteins (LDL)**, **high-density lipoproteins (HDL)**, and/or **triglycerides**. High cholesterol caused by any of these factors increases the risk of **coronary artery disease** and potential heart attack.

High cholesterol is often thought of as an excess amount of LDL ("bad") cholesterol. However, an abnormally low HDL ("good") cholesterol level is an equally important risk factor for heart disease. Elevated triglyceride levels are also associated with increased risk, especially in combination with obesity and other factors.

Cholesterol guidelines (see chart below) are used to identify appropriate cholesterol levels for different individuals. Another valuable tool for predicting coronary artery disease is a **risk ratio**. This calculation measures the ratio of one form of cholesterol to another by dividing total cholesterol by either the HDL or LDL level.

- Optimal risk ratio = 3:5
- Average risk ratio = 4:5
- Increased risk ratio = 5:1

Chylomicron lipoprotein



Exogenous pathway

Exogenous cholesterol is absorbed by the body through the gastrointestinal tract. The transportation of endogenous cholesterol is primarily performed by **low-density lipoproteins (LDL)**, which contain most of the body's total cholesterol.

- **Chylomicrons** in the intestinal wall absorb triglycerides and cholesterol from the diet
- Chylomicrons are hydrolyzed in the **intestinal lymphatic system**
- The triglyceride content of chylomicrons is removed by **lipoprotein lipase**
- Fatty acids are released into **muscle and adipose tissue**

Cholesterol limits

Current guidelines published by the National Cholesterol Education Program (NCEP) recommend **periodic cholesterol testing in all adults** beginning at age 20.

- Adults with normal cholesterol levels require retesting every 5 years
- Patients being treated for high cholesterol should be retested every 2 to 6 months
- Selective screening should be conducted for children with inherited risks of high cholesterol

The NCEP advocates testing for a **total lipoprotein profile**. Current recommendations for total cholesterol, LDL, HDL, and triglyceride levels are listed below.

Total Cholesterol (mg/dL)	HDL Cholesterol (mg/dL)
Desirable: <200	Low: <40
Borderline high: 200-239	High: >60
High: >240	
LDL Cholesterol (mg/dL)	
Optimal: <100	Normal: <150
Near/above optimal: 100-129	Borderline high: 150-199
Borderline high: 130-159	High: 200-499
High: 160-189	Very High: >500
Very High: >190	

Serum Triglycerides (mg/dL)
Optimal: <150
Borderline high: 150-199
High: 200-499
Very High: >500

Causes and treatment of high cholesterol

Causes

High cholesterol is caused by a number of factors that can be controlled to prevent or reduce the risk of heart disease.

High saturated fat and cholesterol intake increase total blood cholesterol by increasing production of cholesterol in the liver and slowing cholesterol elimination from the body.

Being overweight elevates cholesterol levels and increases the risk of heart disease.

A **sedentary lifestyle** increases LDL levels and decreases protective levels of HDL.

Smoking also increases heart disease risks by reducing protective HDL.

Age, gender and heredity also play a role in elevated cholesterol. These factors can make cholesterol levels more difficult to control.

Treatment

Lowering cholesterol can require a combination of diet changes, increased exercise, and medication.

Dietary modification is the most important step in aggressively treating high cholesterol. Recommendations include:

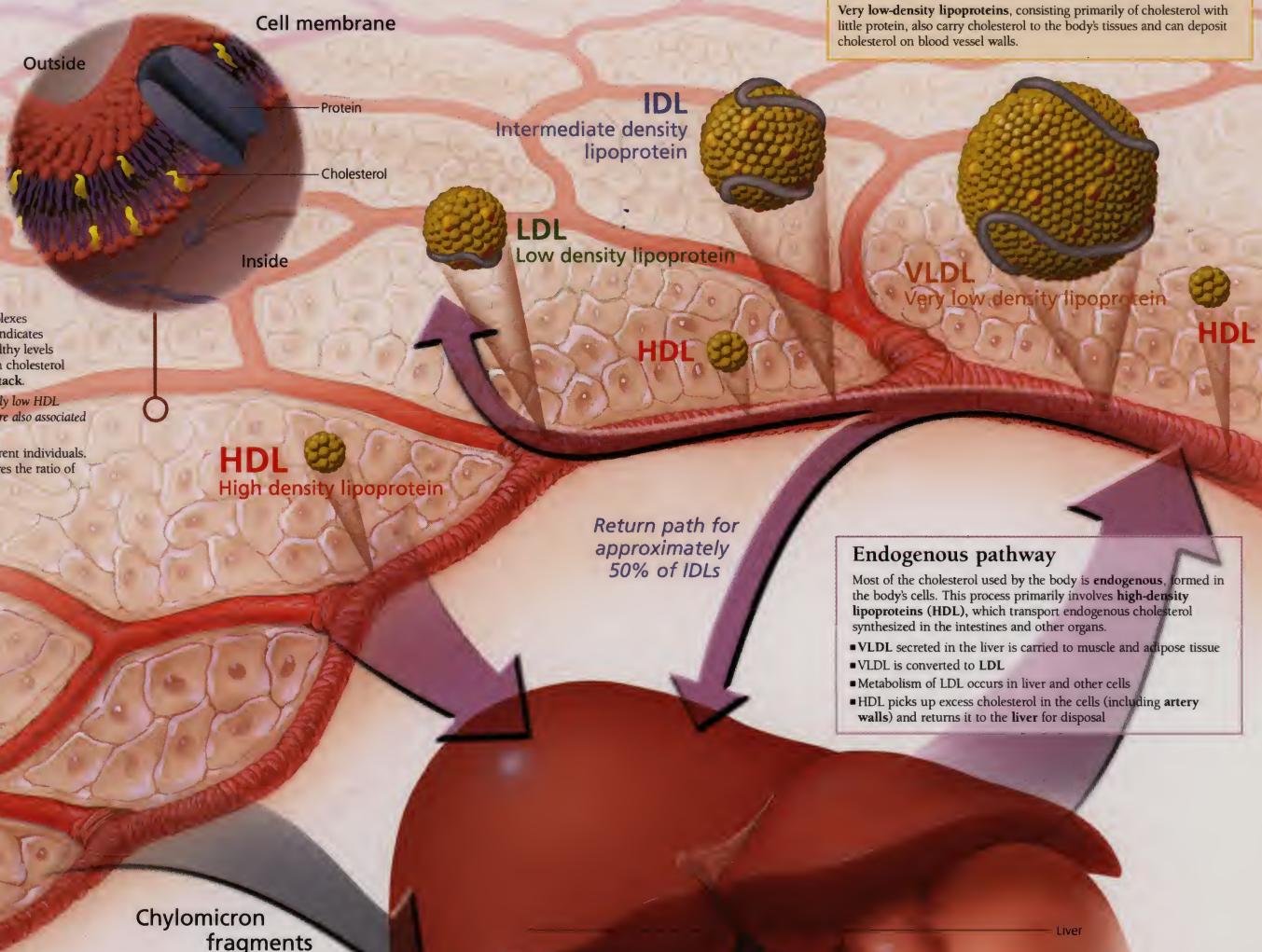
- a maximum 7% daily dietary intake of saturated fats
- replacing saturated fats with unsaturated fats such as olive or canola oil
- a maximum 200 mg/day of cholesterol intake
- increased consumption of fiber-rich foods including whole grains and fruits and vegetables

Regular physical activity is also essential to:

- lower LDL levels
- increase HDL levels
- promote weight loss
- reduce the risk of atherosclerosis

Medication therapy is used to reduce cholesterol when diet and exercise are not sufficient. Lipid-lowering drugs can:

- improve the balance of HDL and LDL
- reduce serum triglyceride levels



How cholesterol travels

High-density lipoproteins carry excess cholesterol away from cells for reprocessing in the liver or elimination through the digestive system. This mechanism protects against high cholesterol as well as atherosclerosis or "hardening of the arteries." When HDL levels are too low, less cholesterol is removed from the tissues and cholesterol levels increase.

Low-density lipoproteins carry cholesterol produced in the liver to tissues throughout the body. High concentrations of LDL are a leading factor in the development of atherosclerosis.

Very low-density lipoproteins, consisting primarily of cholesterol with little protein, also carry cholesterol to the body's tissues and can deposit cholesterol on blood vessel walls.

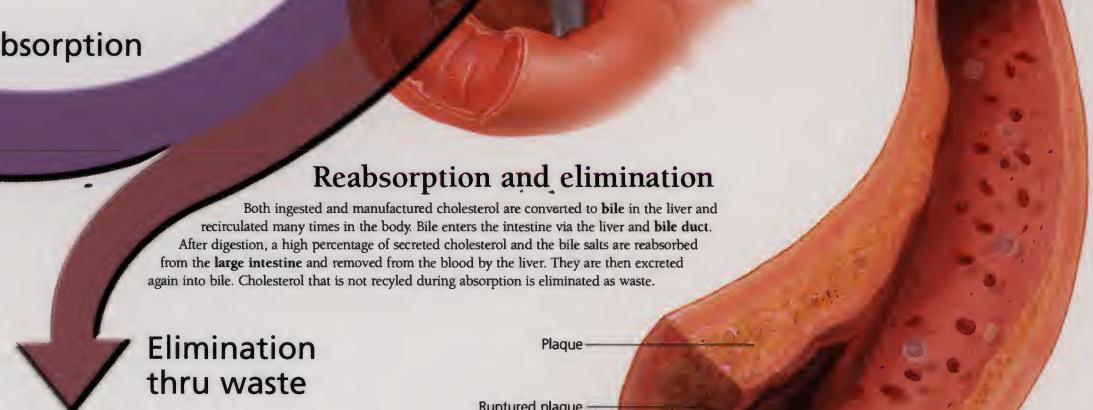
What is a lipoprotein?

Lipoproteins are spherical complexes that carry fat molecules through the blood stream. They consist of a water-soluble outer protein shell, a central phospholipid layer, and an inner cholesterol or triglyceride core. Lipoproteins are categorized by their size and density.

- The smallest lipoproteins carry **cholesterol** (LDL and HDL)
- The largest lipoproteins carry **triglycerides**, the leading source of fat in the diet and body tissues.
- Large lipoprotein complexes include **very low-density lipoproteins (VLDL)** and **chylomicrons**, short-lived compounds that carry dietary cholesterol and triglycerides from the small intestines to the tissues after eating.



Reabsorption



Reabsorption and elimination

Both ingested and manufactured cholesterol are converted to bile in the liver and recirculated many times in the body. Bile enters the intestine via the liver and bile duct. After digestion, a high percentage of secreted cholesterol and the bile salts are reabsorbed from the large intestine and removed from the blood by the liver. They are then excreted again into bile. Cholesterol that is not recycled during absorption is eliminated as waste.

Elimination thru waste



Progression of plaque development

- Oxidized low-density lipoproteins initiate endothelial cell injury
- Fatty streaks consisting of lipid-filled macrophages and lymphocytes appear
- Layers of macrophages and smooth muscle are present
- Lesions or fibrous plaques develop over accumulated lipids and debris, protruding into the artery

What is atherosclerosis?

Atherosclerosis is the gradual buildup of plaque in the arteries, caused primarily by **low-density lipoprotein (LDL)** deposited inside the vessel walls. Localized plaques or atherosomas made up of fats and cholesterol thicken and eventually protrude into the artery. While small atherosomas often remain soft, older atherosomas may become larger and develop fibrous calcium deposits on the surface. During progression of the disease, arteries become increasingly calcified and inelastic, reducing or blocking blood flow and preventing oxygen-rich blood from reaching the heart. Atherosomas present an additional danger if they become sites for blood clots, which may rupture and result in a heart attack.



COPD

Chronic Obstructive Pulmonary Disease

Chronic Obstructive Pulmonary Disease (COPD)

Chronic Obstructive Pulmonary Disease (COPD), also called chronic obstructive lung disease, is used for two related diseases of the respiratory system: **emphysema** and **chronic bronchitis**. In many individuals these diseases occur together, although there may be more symptoms of one than the other. The majority of individuals with COPD have a long history of cigarette smoking.

COPD gradually worsens with time. Initially there may be only a mild shortness of breath and occasional coughing. A chronic cough then develops with a clear, colorless sputum. As the disease progresses, the cough worsens and more effort is needed to get air into and out of the lungs. In later stages, the heart might become affected. Eventually death occurs when the functioning of the lungs and heart is no longer adequate to supply oxygen to the body's organs and tissues.

Approximately 80% - 90% of COPD cases are caused by smoking. Air pollution and occupational exposures play a role, especially when combined with cigarette smoking. By the time symptoms of COPD appear—typically, cough, shortness of breath and difficulty tolerating exercise—damage has already occurred to your lungs.

Emphysema

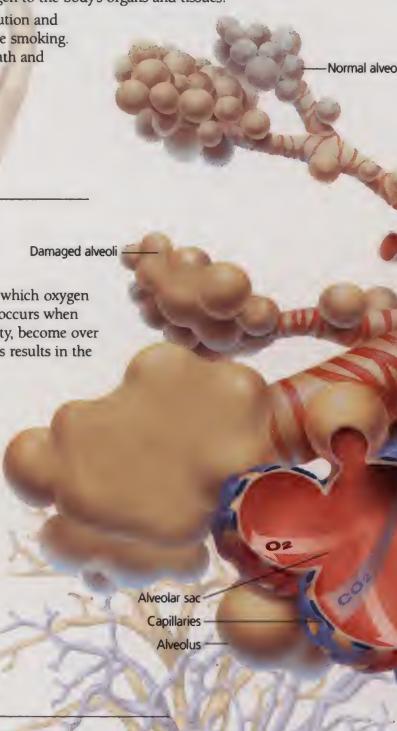
Signs & Symptoms:

- Shortness of breath
- Chronic, mild cough that may produce sputum
- Weight loss

On average, the lungs contain 300 million elastic air sacs, called alveoli, in which oxygen is added to the blood and carbon dioxide is removed from it. Emphysema occurs when there is permanent damage to the alveoli and they lose their natural elasticity, become overstretched and rupture, preventing the lungs from properly functioning. This results in the bloodstream not receiving the required amounts of oxygen.

What Causes Emphysema?

The normal lung has a unique balance between two chemicals with opposing actions. The elastic fibers allow the lung to expand and contract. When the chemical balance is altered the lungs lose the ability to protect themselves against the destruction of these elastic fibers. Smoking is responsible for the majority (80%-90%) of emphysema cases. Individuals born with a protein deficiency known as alpha 1-antitrypsin (AAT) may develop to an inherited form of emphysema.



Chronic Bronchitis

Signs & Symptoms:

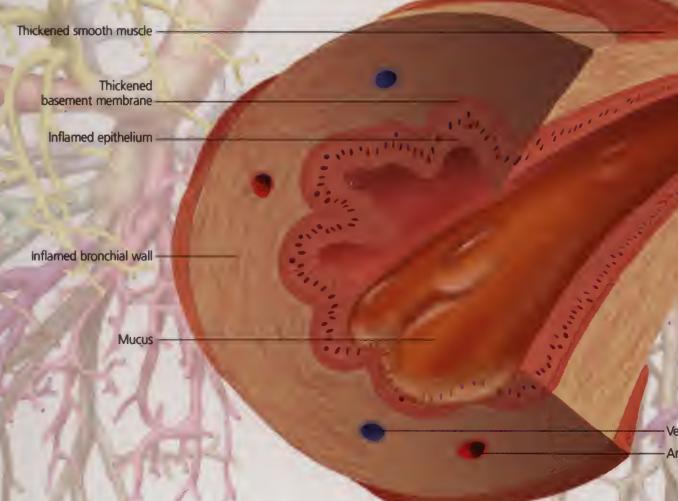
- Chronic cough that produces mucus
- Shortness of breath

This disorder consists of chronic inflammation and thickening of the lining of the bronchial tubes. Pushing the air through narrowed airways becomes harder and harder. In addition, the inflammation causes the glands of the bronchial tubes to produce excessive amounts of mucus, increasing congestion in the lungs and further inhibiting the ability to breath. Air flow is hindered and the lungs are endangered.

The primary symptom of chronic bronchitis (as distinct from emphysema) is a chronic cough that produces large amounts of mucus and has persisted for at least 3 months of the year for more than 2 consecutive years. Once the bronchial tubes have been irritated over a long period of time, excessive mucus is produced constantly.

What Causes Chronic Bronchitis?

In addition to smoking, higher rates of chronic bronchitis are found among coal miners, grain handlers, metal molders, and other workers exposed to dust.



How is Chronic Obstructive Pulmonary Disease Detected?

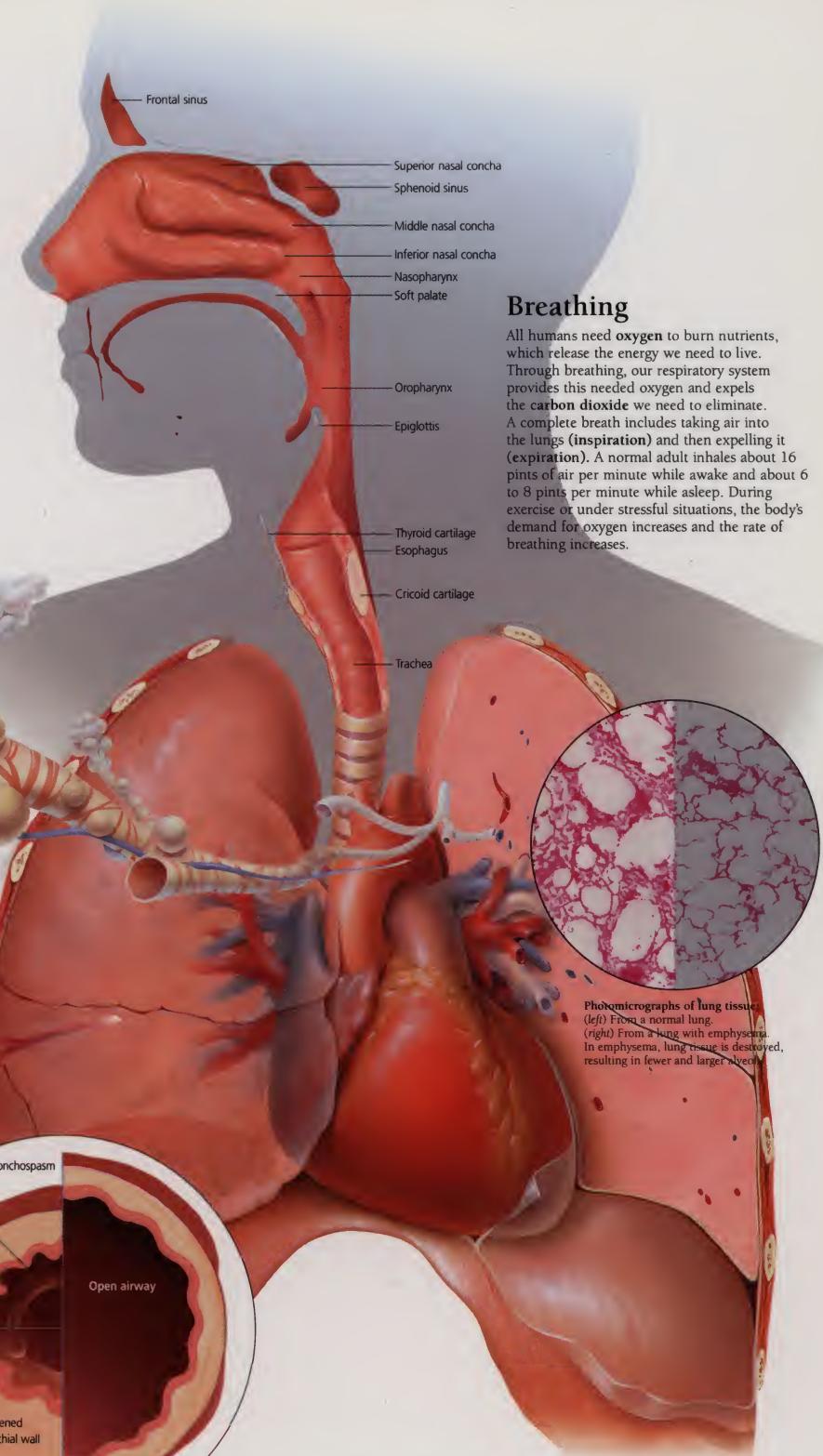
There are no accurate methods to predict an individual's chance of developing COPD. None of the current ways to diagnose COPD detects the disease before irreversible lung damage occurs.

Pulmonary Function Tests

Pulmonary function tests (PFTs) are used to determine lung characteristics and capabilities. These tests include:

- **Total Lung Capacity:** the amount of air the lungs can hold.
- **Forced Expiratory Volume:** how quickly air moves in and out of the lungs.
- **Arterial Blood Gas - Pulse Oximetry:** how efficiently the lungs transfer oxygen from the air into the blood.
- **Arterial Blood Gas:** how efficiently the lungs remove carbon dioxide from the blood.
- **X-Ray:** in moderate to severe cases, a reasonably accurate diagnosis of COPD can be made with a plain chest x-ray and C.T. (Computerized Axial Tomography) scanning.

In most cases, it is necessary to compare the results of several tests in order to make the correct diagnosis, and to repeat some tests at intervals to determine the rate of disease progression or improvement. Test results are compared to values considered healthy for an individual's sex, age, weight, height and race.



Breathing

All humans need **oxygen** to burn nutrients, which release the energy we need to live. Through breathing, our respiratory system provides this needed oxygen and expels the **carbon dioxide** we need to eliminate. A complete breath includes taking air into the lungs (**inspiration**) and then expelling it (**expiration**). A normal adult inhales about 16 pints of air per minute while awake and about 6 to 8 pints per minute while asleep. During exercise or under stressful situations, the body's demand for oxygen increases and the rate of breathing increases.

Taking Control of Your COPD

- Don't smoke.
- Avoid exposures to dusts and fumes.
- Avoid air pollution, cigarette smoke.
- Limit activities during air pollution and ozone alerts.
- Avoid excessive heat, cold and very high altitudes. (Most COPD patients can travel on commercial airlines with pressurized cabins.)
- Limit exposure to people with respiratory infections, colds and the flu.
- Maintain a normal weight. Being over or under weight can worsen the conditions of COPD.
- Drink lots of fluids to loosen sputum so it can be easily coughed up.
- Follow a nutritious, well balanced diet.
- Follow all of your physician's instructions.
- Take prescribed medications as part of your daily routine.
- Don't take other people's medications.
- Consult your physician about an appropriate exercise plan and follow it.

Effective control of COPD can prevent most of its complications.

How is Chronic Obstructive Pulmonary Disease Treated?

Although there is no cure for COPD, the disease can be prevented in many cases. And, in almost all cases the symptoms can be reduced. Survival of individuals with COPD is closely related to the level of their lung function when they are diagnosed and the rate at which they lose this function. The median survival is about 10 years for those with COPD who have lost approximately two-thirds of their normally expected lung function at diagnosis.

There are a number of treatments which can help individuals with COPD. These treatments can be separated into several categories:

- I. Bronchodilators help open narrowed bronchi and bronchial tubes.
- II. Anti-Inflammatories (Steroids) reduce inflammation of the airway walls.
- III. Continuous Oxygen Therapy is recommended for individuals with low blood oxygen levels.
- IV. Lung Reduction Surgery removes damaged areas of the lung so it can perform more efficiently.
- V. Transplant Surgery is a highly complex procedure that is considered a viable option only in a select group of individuals.

Medication and Exercise

Medications for COPD can be given in several forms. The two most common are inhaled or pill medications. Metered dose inhalers (MDIs) are a convenient, safe way to deliver medication. Because the medication goes directly to the lungs, smaller doses can be used with minimal side effects. Proper technique in using hand-held inhalers is very important to their effectiveness.

Frequently prescribed medications for COPD patients include:

- Bronchodilators to open narrowed airways
- Corticosteroids or steroids to reduce inflammation
- Antibiotics to fight respiratory infections
- Expectorants to loosen and expel mucus secretions from airways
- Diuretics to help excrete excess body fluids
- Digitalis to strengthen the force of the heartbeat
- Other drugs may include tranquilizers, pain killers, cough suppressants.

After smoking cessation, exercise is important to the nonmedical treatment of COPD. Exercise builds and maintains strength, maintains flexibility of the bones and joints, and builds stamina to increase the amount of activity possible for a COPD patient. A physician, respiratory therapist or physical therapist should always be consulted before setting up a specific exercise program.



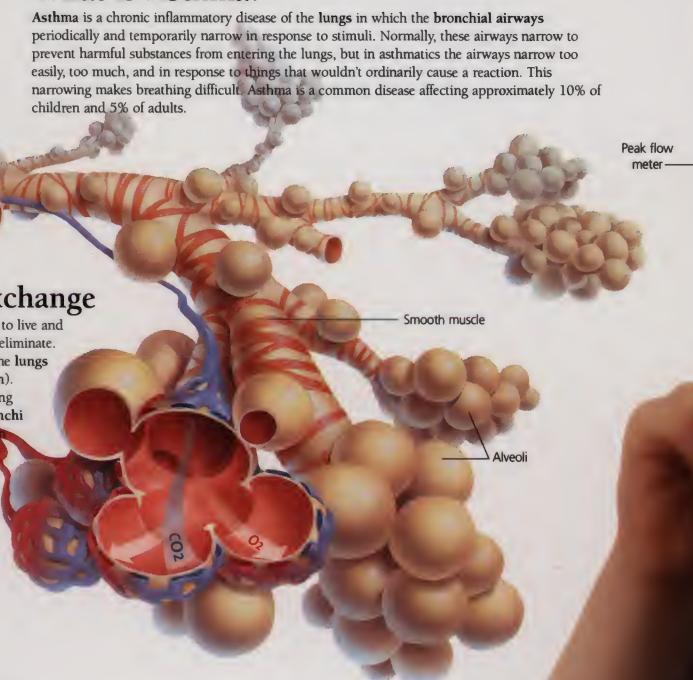
Understanding Asthma

What is Asthma?

Asthma is a chronic inflammatory disease of the lungs in which the bronchial airways periodically and temporarily narrow in response to stimuli. Normally, these airways narrow to prevent harmful substances from entering the lungs, but in asthmatics the airways narrow too easily, too much, and in response to things that wouldn't ordinarily cause a reaction. This narrowing makes breathing difficult. Asthma is a common disease affecting approximately 10% of children and 5% of adults.

Breathing & Gas Exchange

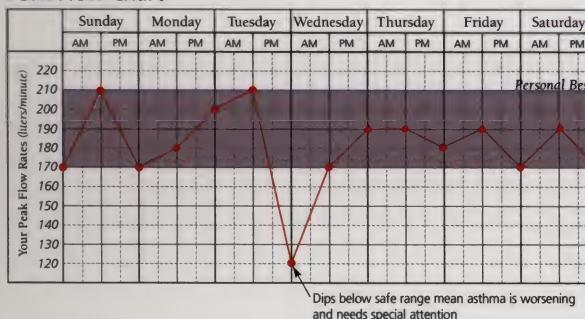
Breathing provides the oxygen (O_2) we need to live and expels the carbon dioxide (CO_2) we need to eliminate. A complete breath consists of taking air into the lungs (inspiration) and then expelling it (expiration). Inspired air travels through the lungs' branching network of progressively smaller airways (bronchi and bronchioles) until reaching the more than 300 million tiny, thin-membraned **alveoli** where gas exchange occurs. Gas exchange of O_2 and CO_2 occurs through the walls of the alveoli and the walls of the blood-carrying capillaries that envelop the alveoli.



Measuring Air Flow

Measuring air movement out of your lungs can be helpful in understanding and managing asthma. The **peak expiratory flow rate (PEFR)** is a measurement of the force and speed of air blown out of the lungs and can be measured at home with an easy-to-use **peak flow meter**. By recording your results on a **peak flow chart** and comparing them to your personal best score (the highest score over a 2-3 week period while your asthma is under good control), you can gauge how your asthma is doing, what makes it worse, how effective your medications are, and when to seek emergency help.

Peak Flow Chart



Allergies & Asthma

Allergies play a significant role for many asthmatics: about 80% of children and 50% of adults with asthma have allergies. Allergies are the result of the body's immune system perceiving a harmless foreign substance (allergen) as dangerous. In asthmatics, allergic reactions can trigger an asthma attack when common allergens, such as pollens, mold spores, dust mites, cockroach particles, and animal danders are inhaled into the lungs.

People with allergies make large quantities of certain **antibodies** (IgE) against specific allergens. These antibodies are located on the surface of **mast cells**—immune system cells abundant in the lining of the nose and lungs. When these antibodies are exposed to the allergen, mast cells are triggered to release chemicals called **mediators** (histamine) into the surrounding area. These chemicals irritate the tissues and cause allergic symptoms, such as runny eyes and nose, but also the immediate response of an asthma attack—**bronchospasm** and mucus production.



Close-up of Airway Wall



Inflammation

It was once believed that asthma was simply episodes of bronchospasm by the smooth muscle. Today, the focus is **inflammation**. Inflammation is thought to play a critical role in airway obstruction and trigger sensitivity. Controlling inflammation has become a central objective of asthma therapy. Reducing the underlying inflammation is believed to reduce spontaneous bronchospasm and possibly prevent long-term damage to the airways. Better control of inflammation is essential to better long-term and short-term control of asthma.

Children & Asthma

Asthma is the most common chronic illness in children. The number of cases are increasing and many are believed yet undiagnosed. Childhood respiratory asthma is thought to be genetically predisposed and is closely associated with allergies. Frequent respiratory infections and coughing, including coughing after exercise, recurrent nighttime coughing and ratty coughs of infants, should be evaluated for asthma. Children with asthma should be tested for allergies and once identified, avoid triggers, such as second-hand smoke. The ultimate goals of treating children are to rid of symptoms, restore normal lung function and allow them to lead a *full and active life*.

What Causes Asthma?

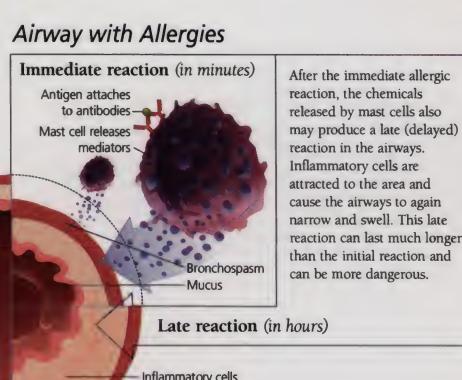
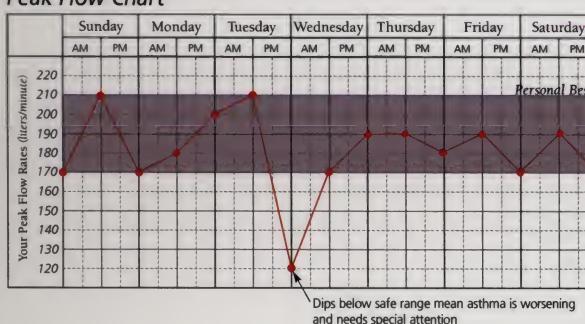
The exact cause of asthma is not known, but it is believed that there are hereditary and environmental factors involved. Once someone has asthma, there are factors that can cause or "trigger" an asthma attack. Identifying and avoiding triggers can help control asthma and play an important role in its treatment.

Common Triggers

- Allergens - dust, molds, pollens, animal danders, cockroach particles
- Exercise - vigorous activities like running
- Cold damp air
- Time of day - early morning hours
- Respiratory tract infections - viruses
- Emotions - laughing, crying, stress
- Drugs - especially aspirin and other NSAIDS
- Irritants - tobacco smoke, house hold cleaners, etc.
- Occupational factors - triggers at work
- Ozone



Peak Flow Chart



Treatment of Asthma

The goals of asthma treatment are to eliminate symptoms and prevent acute attacks. Fortunately for people afflicted with asthma, safe, sensible drug treatments will control their disease.

Medications

Relievers usually delivered by inhalers, open constricted airways and provide temporary relief of symptoms during an attack; however, they don't relieve inflammation. Most relieve symptoms for 6 hours, but some provide relief for up to 12 hours.

Examples of bronchodilators are β -agonists and theophylline.

Preventers reduce inflammation in the airways and are taken continuously to help prevent or decrease the frequency of attacks.

Examples of these drugs are inhaled steroids, leukotriene modifiers and others.

Alternative Treatments

Yoga, hypnosis and acupuncture may help relieve anxiety and hyperventilation that can make asthma attacks worse.

Take Control of Your Asthma

- Have a complete physical exam by a physician
- Understand asthma and its treatment
- Develop a written action plan with your physician to manage improvements or attacks and review the plan regularly.
- Take prescribed medications according to your plan
- Identify and avoid triggers as much as possible
- Monitor your lung function at home
- Be aware of your symptoms
- Follow all of your physician's instructions
- If exercise makes your asthma worse, discuss options with your physician



Understanding The Common Cold

What is a Common Cold?

The common cold is an infection of the head and chest caused by a virus (germ that causes infections) located in the nose. Colds also involve the sinuses, ears, bronchial tubes, and the tube that connects the middle ear and throat, windpipe, voice box and airways (the Eustachian tube).

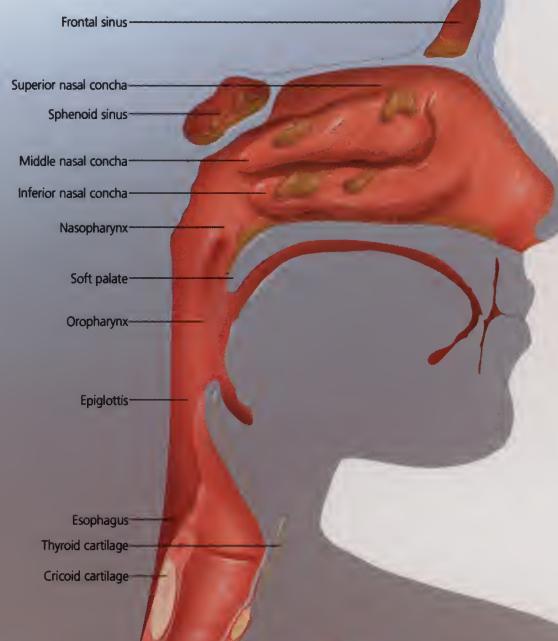
The symptoms of a common cold include:

- Sneezing
- Runny nose, nasal obstruction
- Sore or scratchy throat, cough, hoarseness.

Other symptoms include headache, feverishness, chills and general feeling of not being well.

A cold is a milder illness than influenza — influenza typically causes symptoms including fever, muscle aches—but mild cases can be similar to the common cold. Most common colds last two to three days, but severe colds can last up to two weeks. More serious bacterial infections of the ears, sinuses, throat and lungs may be associated with a viral respiratory infection (see below). Adults typically average two to three colds a year while children experience six to ten colds a year. Newborn children acquire temporary immunity to cold viruses from their mother, but after six months this immunity has lessened and they are also susceptible to cold viruses.

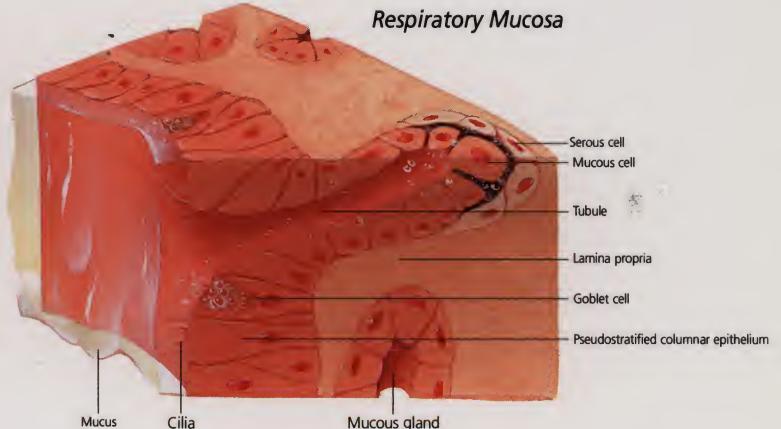
Cross Section of Paranasal Sinuses



How a Cold Virus Infection Occurs

A cold virus enters the body through the front of the nasal passages by contaminated fingers or droplets from coughs and sneezes. The virus is then transported by the nose to the back of the nose and onto the adenoid area. Virus receptors on the nasal cells and the adenoid give the virus access into cells, which are then infected with the virus. New virus particles are produced in these infected cells, which eventually die and rupture, releasing newly produced cold viruses to infect other cells and the cycle continues. Only small doses of the virus (2-30 particles) are necessary to produce an infection. At present, over 200 cold viruses have been identified.

Respiratory Mucosa



Treatment

There are no medications presently available that can cure the common cold, but symptoms can be treated and alleviated with nonprescription medicines such as aspirin, acetaminophen, nose drops and sprays, cough syrups, drops and throat lozenges. As always, check with your physician prior to taking any additional drugs if you're already taking prescription or over-the-counter drugs.

It's important to note that children should never be given aspirin because of the danger of it causing brain damage (Reyes syndrome).



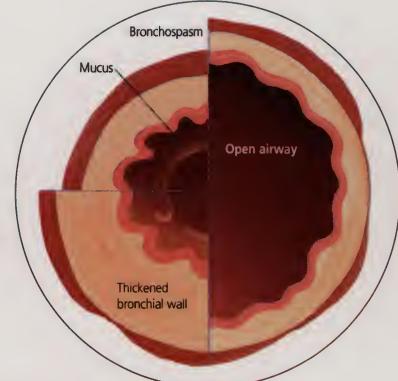
What Causes Cold Symptoms?

Cold symptoms are the result of the body's perceived response to the infection. When a nasal cell is infected by the cold virus, the body responds by activating some parts of the immune system and nervous system reflexes.

As part of this process, certain inflammatory mediators, which are contained in the immune system and are designed to protect the body from infection and other threats to the system, are released. Once activated by the viral infection, these inflammatory mediators promote dilation and leakage of blood vessels and mucous gland secretion. They also activate sneeze and cough reflexes and stimulate pain nerve fibers resulting in what we experience as cold symptoms. (The activity of inflammatory mediators is not necessary to recover from a cold. Twenty-five percent of individuals who recover from colds don't have cold symptoms and experience no difference in their recovery rate.)

Reducing the Spread of Colds

- Limit contact with cold sufferers, especially during the initial stages
- Wash hands contact with cold sufferers. (Make hand washing part of your daily routine).
- Avoid touching your eyes and nose. (Fingers transmit germs).



Inflammation of bronchial airway

Complications of Colds

Acute Bacterial Sinusitis

When a common cold lasts longer than seven to ten days, bacterial sinusitis may have developed and additional care may be needed. Treatment for acute bacterial sinusitis typically requires antibiotic treatment to combat the illness and prevent further complications such as eye infections, bacterial meningitis and brain abscess. With proper treatment, over 90% of such infections are cured.

Middle Ear Infections

Middle ear infections (Otitis Media) are most common in children, but can also occur in adults. Children and infants are more prone to Otitis Media because their Eustachian tubes are not fully developed. During a common cold, secretions can accumulate in the Eustachian tube, which connects the back of the throat to the middle ear, and obstruct the Eustachian tube. When this happens, fluid collects in the middle ear causing Serous Otitis Media. If bacteria become trapped in the middle ear, an infection can result (Bacterial Otitis Media).

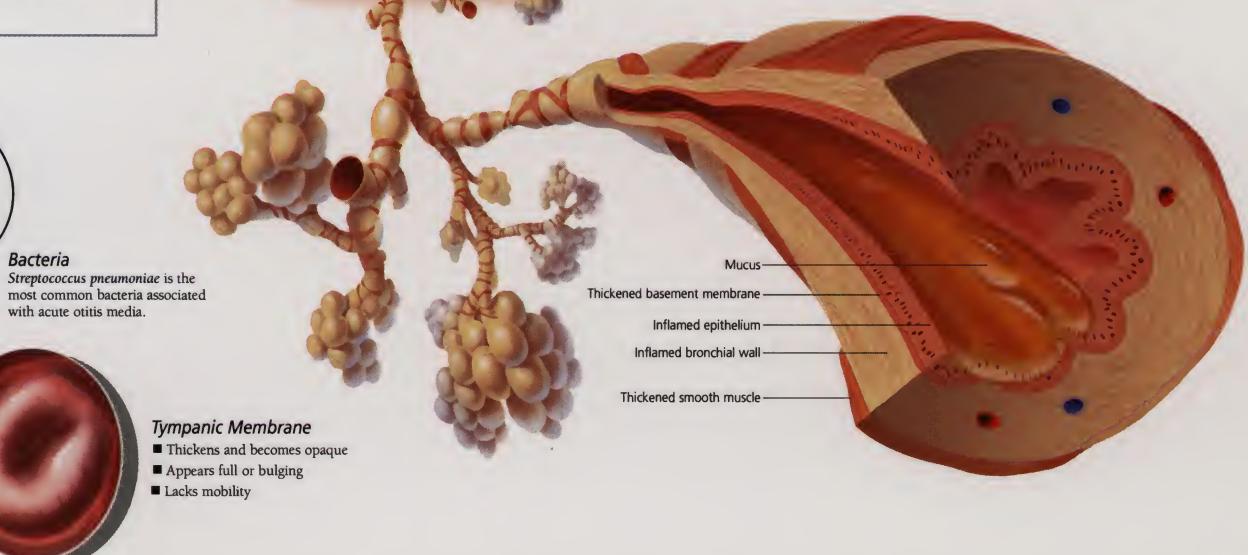
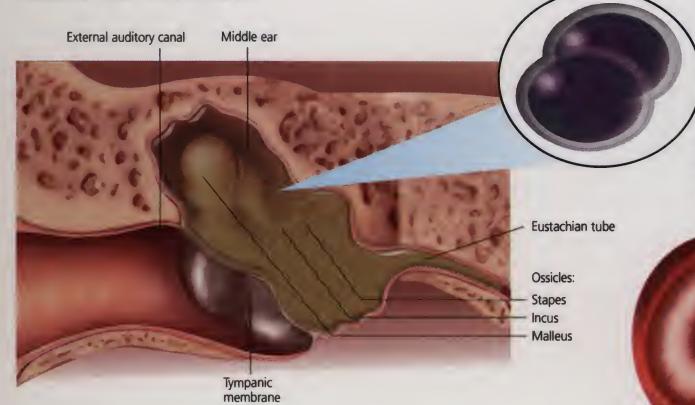
Asthma Attacks

Common colds are a frequent cause of asthma attacks, particularly in children. People who suffer from asthma should avoid people with fresh colds and take precautions to avoid contracting colds.

Worsening of Chronic Bronchitis

Common cold infections can cause worsening of chronic bronchitis symptoms in patients with this condition, characterized by increased coughing, sputum, shortness of breath and fever. For acute attacks of chronic bronchitis, antibiotic treatment is recommended. Individuals with chronic bronchitis, and other kinds of serious lung and heart diseases should avoid people with colds if at all possible.

Middle Ear Infections



Tympanic Membrane

- Thickens and becomes opaque
- Appears full or bulging
- Lacks mobility



COPD & Asthma

There is a difference

What is COPD?

Chronic Obstructive Pulmonary Disease

Chronic Obstructive Pulmonary Disease (COPD), also called chronic obstructive lung disease is used for two related diseases of the respiratory system: chronic bronchitis and emphysema. In many individuals these diseases occur together, although there may be more symptoms of one more than the other. The majority of individuals with COPD have a long history of cigarette smoking.

COPD gradually worsens with time. Initially there may be only a mild shortness of breath and occasional coughing. A chronic cough then develops with a clear, colorless sputum. As the disease progresses, the cough worsens and more effort is needed to get air into and out of the lungs. In later stages, the heart might become affected. Eventually death occurs when the functioning of the lungs and heart is no longer adequate to supply oxygen to the body's organs and tissues.

Emphysema

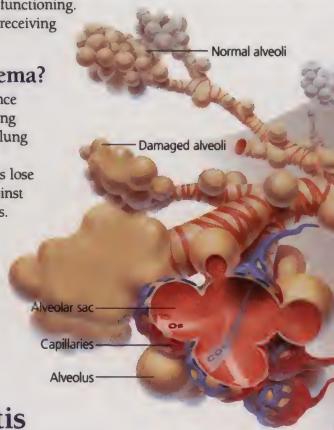
Signs & Symptoms

- Shortness of breath
- Chronic, mild cough that may produce sputum
- Weight loss

On the average lungs contain 300 million elastic air sacs, called alveoli, in which oxygen is added to your blood and carbon dioxide is removed from it. Emphysema occurs when there is permanent damage to the alveoli and they lose their natural elasticity, become over-stretched and rupture, preventing the lungs from properly functioning. This results in the bloodstream not receiving the required amounts of oxygen.

What Causes Emphysema?

The normal lung has a unique balance between two chemicals with opposing actions. The elastic fibers allow the lung to expand and contract. When the chemical balance is altered the lungs lose the ability to protect themselves against the destruction of these elastic fibers. Smoking is responsible for the majority (80%-90%) of emphysema. Individuals born with a protein deficiency known as alpha 1-antitrypsin (AAT) may develop an inherited form of emphysema.



Chronic Bronchitis

Signs & Symptoms

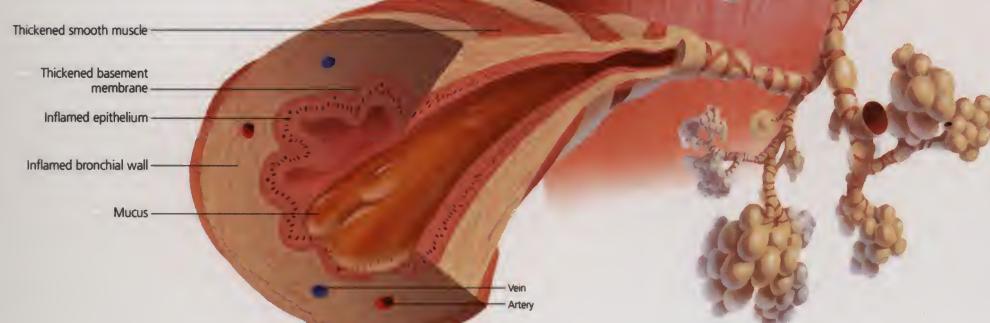
- Chronic cough that produces mucus
- Shortness of breath

This disorder consists of chronic inflammation and thickening of the lining of the bronchial tubes. Pushing the air through narrowed airways becomes harder and harder. In addition, the inflammation causes the glands of the bronchial tubes to produce excessive amounts of mucus, increasing congestion in the lungs and further inhibiting the ability to breathe. Air flow is hindered and the lungs are endangered.

The primary symptom of chronic bronchitis (as distinct from emphysema) is a chronic cough that produces large amounts of mucus and has persisted for at least 3 months of the year for more than 2 consecutive years. Once the bronchial tubes have been irritated over a long period of time, excessive mucus is produced constantly.

What Causes Chronic Bronchitis?

In addition to smoking, higher rates of chronic bronchitis are found among coal miners, grain handlers, metal molders, and other workers exposed to dust.



How is Chronic Obstructive Pulmonary Disease Treated?

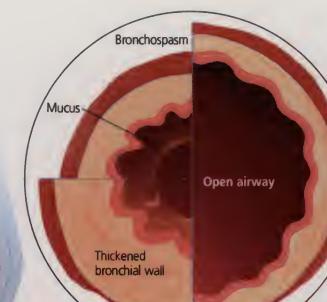
Although there is no cure for COPD, the disease can be prevented in many cases. And, in almost all cases the symptoms can be reduced. Survival of individuals with COPD is closely related to the level of their lung function when they are diagnosed and the rate at which they lose this function. The median survival is about 10 years for those with COPD who have lost approximately two-thirds of their normally expected lung function at diagnosis.

There are a number of treatments which can help individuals with COPD. These treatments can be separated into several categories:

- I. Bronchodilators help open narrowed bronchi and bronchial tubes.
- II. Anti-Inflammatories (Steroids) reduces inflammation of the airway walls.
- III. Oxygen continuous oxygen therapy is recommended for individuals with low blood oxygen levels.
- IV. Lung Reduction Surgery this surgery removes damaged areas of the lung so it can perform more efficiently.
- V. Transplant Surgery lung transplantation is a highly complex procedure which is viable option only in a select group of individuals.
- VI. Pulmonary rehabilitation programs combined with medical treatment to improve overall physical endurance and sense of well-being.

COPD vs. Asthma: Diagnostic Markers

Diagnostic Markers	COPD	Asthma
Age	Patient typically over 40	Typically presents at an early age
Smoking History	Smokers and ex-smokers	No direct correlation between smoking and asthma
Dyspnea	Shortness of breath, especially upon exertion	Episodic attacks especially upon exposure to allergen/irritant/exercise
Cough	Productive cough, typically in the morning	Cough typically in the evening
Spirometry	FEV1/FVC ratio 70%	FEV1/FVC ratio low during attacks only
Daily variation in peak expiratory flow rate (PEFR)	Little	Morning dip and day-to-day variability
Effect of corticosteroid trial	Inconclusive (improvement in <20% of patients)	Improvement
Eosinophilia	No	Maybe
Chest X-Ray	Over inflation	Over inflation during attacks



What is Asthma?

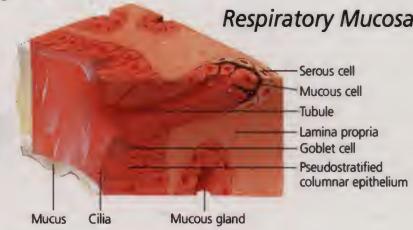
Asthma is a chronic inflammatory disease of the lungs in which the bronchial airways periodically and temporarily narrow in response to stimuli. Normally, these airways narrow to prevent harmful substances from entering the lungs, but in people with asthma the airways narrow too easily, too much, and in response to things that wouldn't cause a reaction in non-asthmatics. This narrowing makes breathing air into and out of the lungs difficult. Asthma is a common disease affecting approximately 10% of children and 5% of adults.

An Asthma Attack

Signs & Symptoms

- Difficulty breathing
- Wheezing
- Coughing
- Tightness of chest
- Early morning wakening
- Nighttime coughing in children

Asthma attacks can vary from mild to severe and can last minutes or days. Once an asthma attack is triggered, the muscles in the airways tighten (bronospasm), the mucosal lining of the airways swells (inflammation) and there is an increase in mucus production in the airways. All these add to narrowing of the airways, which makes breathing difficult and produces the wheezing sound associated with asthma. While most asthma attacks are mild to moderate, severe attacks can be life threatening. In a severe attack the thick mucus can form plugs in the narrowed airways and completely block the flow of air to the alveoli, preventing gas exchange.



What Causes Asthma?

The exact cause of asthma is not known, but it is believed that there are hereditary and environmental factors involved. Once someone has asthma there are factors which can cause or "trigger" an asthma attack. Identifying and avoiding triggers can help control asthma and play an important role in its treatment.

Common Triggers

- Allergens—dust, mold, pollen, animal dander
- Exercise—vigorous types like running
- Cold air
- Irritants—cigarette smoke, cleaners, etc.
- Time of day—early morning hours
- Respiratory tract infections—viruses
- Emotions—laughing, crying
- Drugs—especially aspirin and other NSAIDS
- Occupational factors—triggers at work
- Sleep



How is Asthma Treated?

The ultimate goal of treating asthmatics is to produce freedom from symptoms and prevent acute attacks. Fortunately, most asthmatics can have their disease controlled by safe drug treatment with minimal side effects.

Medications

Relievers (bronchodilators), usually delivered by inhalers, open constricted airways and provide temporary relief of symptoms during an attack, but don't relieve inflammation. They usually relieve symptoms for 6 hours but some provide relief for up to 12 hours. Examples of these drugs are β -agonists, theophylline and short-course oral steroids.

Preventers (anti-inflammatory medications) reduce inflammation in the airways and are taken continuously to help prevent or decrease the frequency of attacks. Examples of these drugs are inhaled steroids, leukotriene modifiers and other anti-inflammatory drugs.

Alternative Treatments

Yoga, hypnosis and acupuncture may help with anxiety and hyperventilation which can make asthma attacks worse.



The Common Cold vs. The Flu

What is a common cold?

The common cold is an infection of the nose and throat caused by a virus (a microscopic infectious agent or 'germ'). Colds can involve the sinuses, ears, bronchial tubes and the eustachian tube, which connects the middle ear and throat, windpipe, voice box and airways. Infection with a cold virus is less severe than influenza but mild cases of flu can sometimes appear similar to a common cold. Cold symptoms include sneezing, runny or blocked nose, sore throat, cough and low grade fever. Most common colds occur gradually and last two to three days; severe colds can last up to two weeks.

How a cold virus infection occurs

The cold virus is present in the mucus and saliva of an infected person. You can catch a cold when the cold virus enters your nasal passages. This may be through contaminated fingers or airborne droplets from cough and sneezes. The virus enters healthy cells in the nose and the adenoid, which become infected and produce new virus particles. As cells die, new cold viruses are released and infect other cells. Only small doses of the virus (2-30) particles are necessary to produce an infection. At present, over 200 cold viruses have been identified.

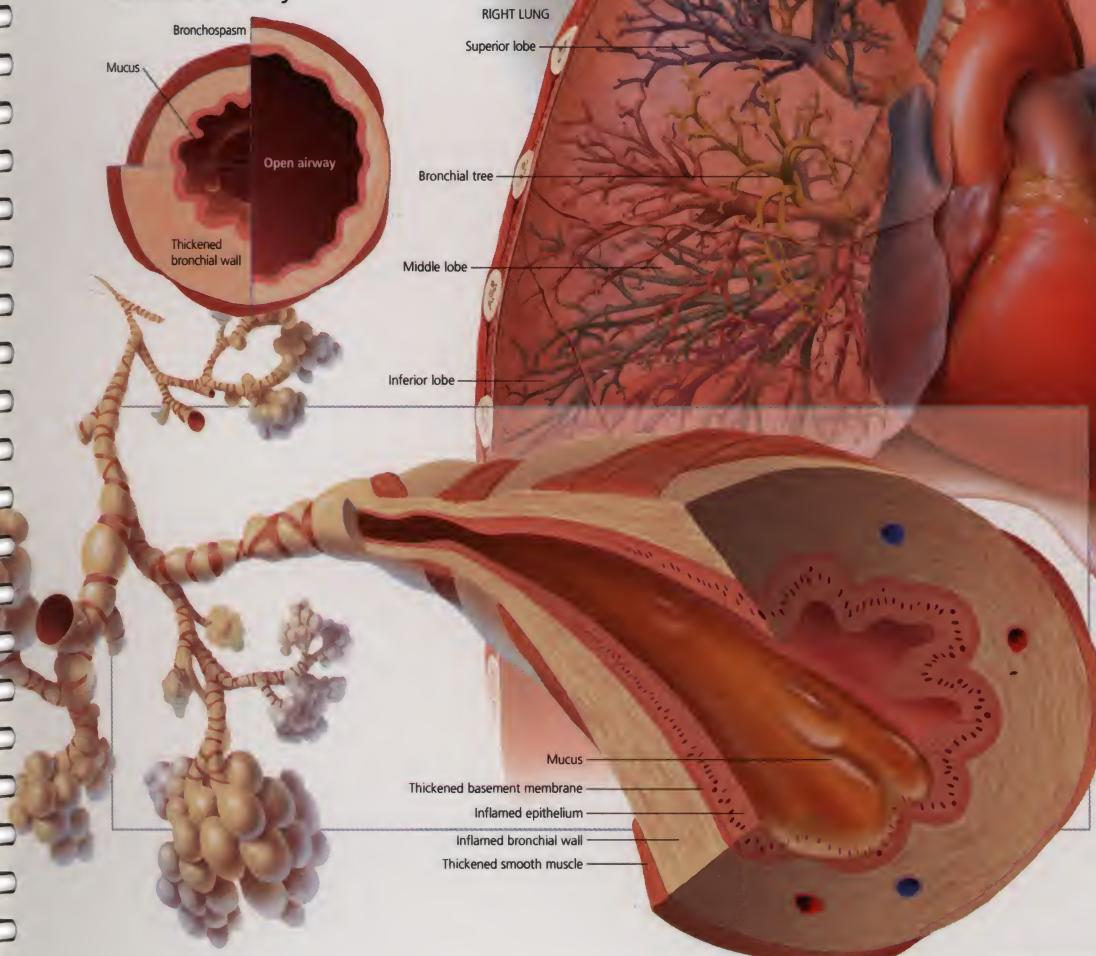
Treating a cold

There are no medications presently available that can cure the common cold, but symptoms can be treated or alleviated with nonprescription **analgesics** such as paracetamol and ibuprofen, as well as over-the-counter **decongestants**, **cough syrups** and **throat lozenges**. (Check with your physician prior to taking any medication if you are already taking prescription or over-the-counter drugs.) Plenty of rest and fluids to thin mucus secretions are also important.

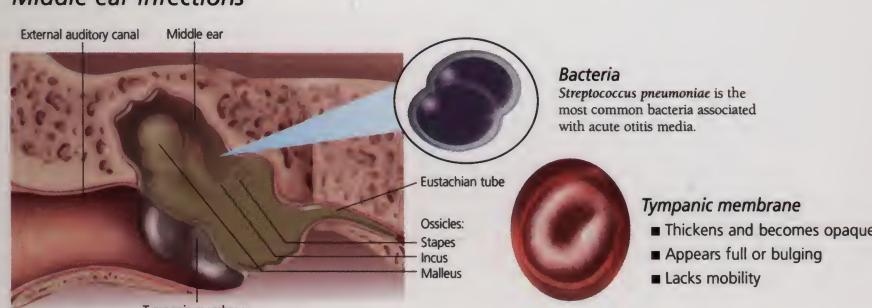
Aspirin and colds/flu

Aspirin should never be given to children or teenagers who have cold or flu-like symptoms, particularly fever, due to the risk of a rare but dangerous complication of influenza known as **Reyes syndrome**.

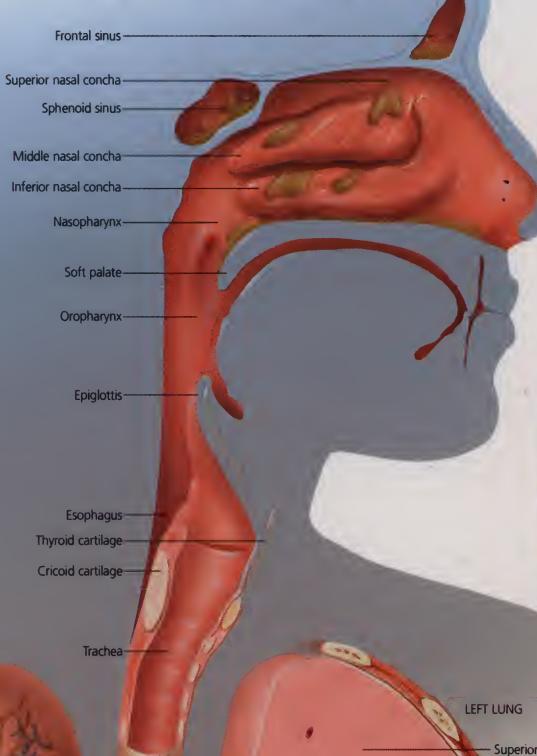
Inflammation of bronchial airway



Middle ear infections



Cross section of paranasal sinuses



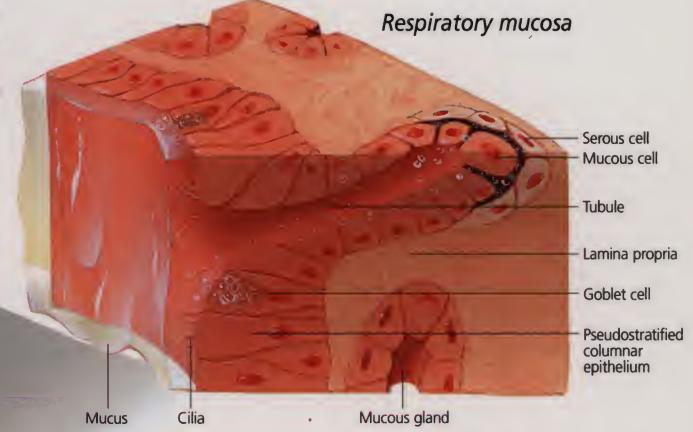
What is the flu?

"Flu" is the common name for **influenza**, a viral illness of the respiratory tract. Infection occurs in the nose, throat, bronchial tubes and lungs. Symptoms, such as muscle aches, fever and chills, usually begin suddenly, are more severe and last longer than common cold symptoms. Because infection with an influenza virus can damage the lungs, it can lead to significant complications such as **pneumonia**. Those most at risk of serious complications of influenza are children, older people (over 65), people with chronic illnesses (such as asthma, heart disease or diabetes) and people with compromised immune systems.

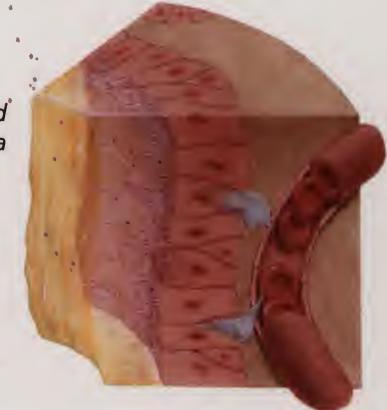
How flu virus is transmitted

The coughing, sneezing and talking of an infected person releases millions of tiny droplets containing the virus into the air. Once inhaled, they enter the body and reproduce in healthy cells, infecting the lining of the respiratory tract. Influenza virus is highly contagious and can be transmitted up to seven days after symptoms begin.

Respiratory mucosa



Inflamed respiratory mucosa



Flu diagnosis, treatment, and prevention

Testing

Influenza is usually diagnosed from symptoms; however, **laboratory tests** may also be used to confirm the type or presence of influenza virus and to guide treatment decisions.

Treatment

Treatment includes rest, fluids and over-the-counter **analgesics** to alleviate symptoms such as fever and muscle aches. In some cases **prescription antiviral medications** may help to prevent or reduce the severity of symptoms.

Prevention

Immunization is considered the **most important treatment** for influenza. People who are at increased risk of influenza complications should receive a flu shot every year.

Reducing the spread of colds and flu

- Limit contact with infected individuals
- Wash hands frequently after contact
- Avoid touching your eyes and nose to reduce the spread of germs by your fingers

The influenza virus: a changing threat

There are three types of influenza virus, classified as Types A, B and C. The most potentially dangerous of these is Type A, which can spread easily and rapidly through large populations. Type B usually affects fewer people and is less severe. Type C causes only mild symptoms.

Frequent changes in the genetic makeup of influenza viruses make it impossible to prevent flu with the same vaccine year after year. Vaccines are reformulated annually to keep up with changes in virus strains. A **flu shot** is recommended every year to provide the most current protection for high-risk groups.

Common cold vs. flu: Understanding the difference

COMMON COLD

Primary symptoms - gradual onset

- Runny nose, sneezing, watery eyes
- Sore or scratchy throat
- Mild cough
- Fatigue
- Occasional low grade fever (<38.5°C or 101°F)

Complications

- Middle ear infections (otitis media)
- Acute bacterial sinusitis
- Asthma attacks and worsening of chronic bronchitis

Prevention

- No preventive treatment

INFLUENZA

Primary symptoms - acute onset

- Severe headache and/or muscle aches
- Fever of 39-40°C to 102-104°F (may last 3-4 days)
- Fatigue/exhaustion (may last two weeks or more)
- Chills
- Cough (can become severe)

Complications

- Pneumonia
- Bronchial, ear, and sinus infections
- Worsening of chronic conditions such as asthma, congestive heart failure, and diabetes

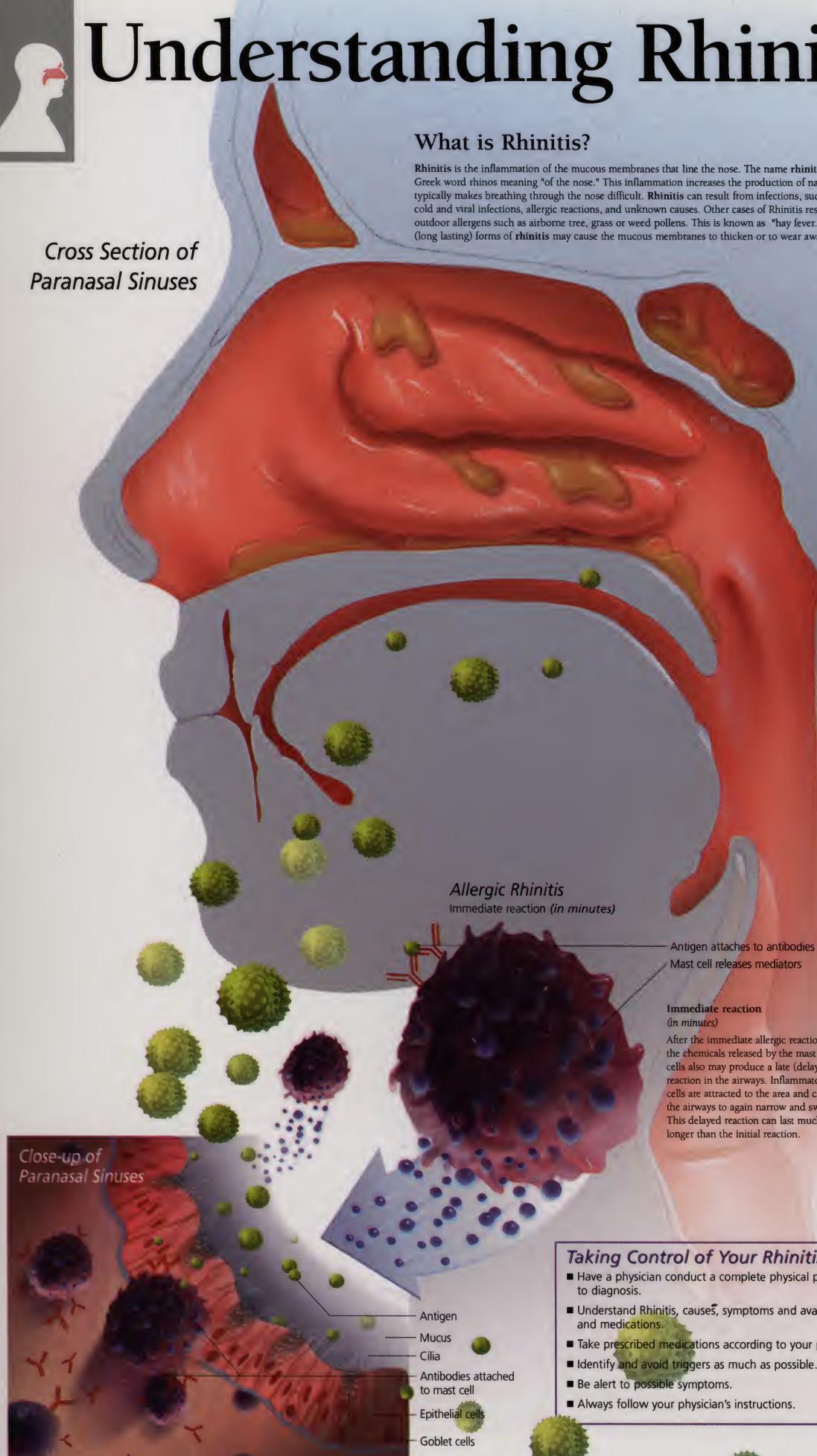
Prevention

- Annual flu shots recommended for high-risk groups
- Sometimes antiviral medications may be used to prevent flu and reduce symptom duration and severity

Understanding Rhinitis



Cross Section of Paranasal Sinuses



Treatment of Rhinitis

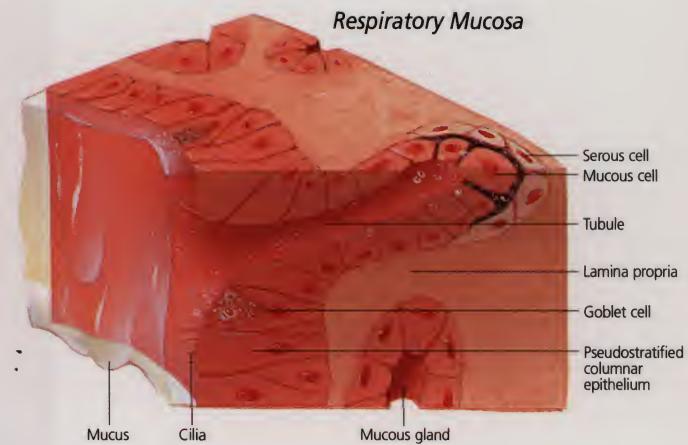
The ultimate goal in treating allergic and nonallergic rhinitis is to provide relief from the symptoms and prevent acute attacks from taking place. Most cases of mild allergic rhinitis require little more than reducing exposure to allergens and using a nasal wash. Fortunately there are a number of medications available, which can alleviate symptoms, with minimal side effects, for the more severe or chronic forms of rhinitis.

Treatments for rhinitis, as determined by your physician and based on your condition, include:

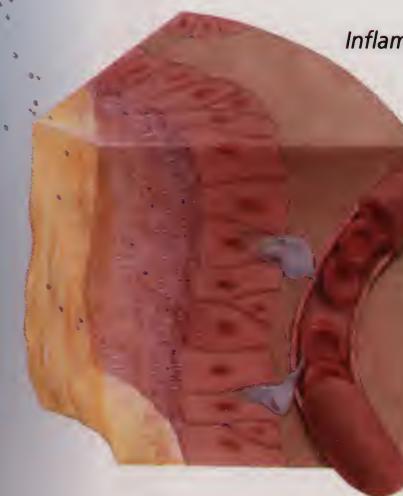
- Inhaled medications*
- Oral medications
- Immunotherapy (allergy shots)
- Surgery for some conditions

*Relievers also known as bronchodilators are usually delivered by inhalers. They open constricted airways to provide temporary relief for symptoms, but don't relieve inflammation. They typically relieve symptoms for six hours, but some provide relief for up to twelve hours. Examples of these medications include decongestant/antihistamine combinations.

Preventors (anti-inflammatory medications) reduce inflammation in the airways and are taken continuously to help prevent or decrease the frequency of attacks. Examples of these drugs are antihistamine tablets, nasal corticosteroids (commonly called steroids and considered to be the most effective in preventing allergy attacks) and nasal cromolyn for mild cases.

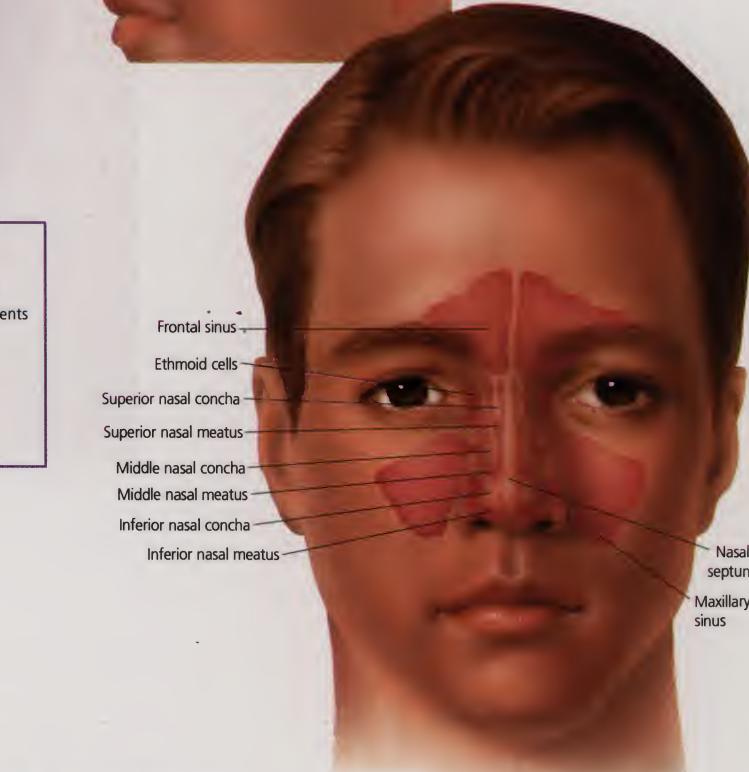
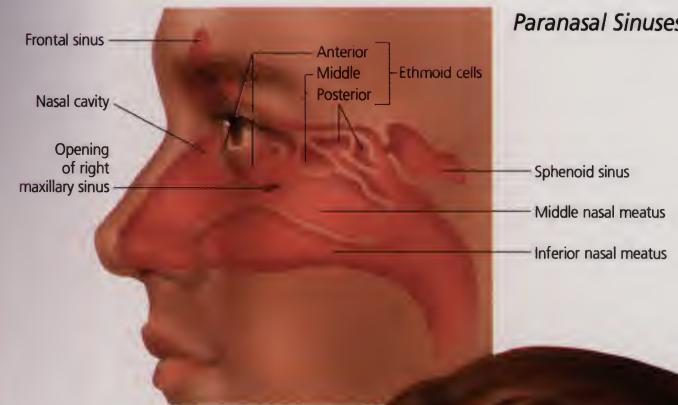


Inflamed Respiratory Mucosa



Inflammation

As we breathe, foreign particles, viruses and bacteria attach to the mucous membranes of sinuses to produce a clear mucus that washes the inside of the nose. In the event of a massive invasion of foreign micro-organisms, such as a virus, our body responds with a full defense called **inflammation**, characterized by heat, swelling and pain. The delivery of increased blood supply and heat from the interior of the body (fever) helps the body's defense system to function more effectively and slows the growth of the invading organisms. Fluid from the blood vessels leaks into the inflamed area, causing swelling and delivering antibodies. Invaders are broken down and devoured by granulocytes.



Types of Rhinitis:

Rhinitis is typically classified into the following categories:

Acute r. If symptoms last less than six weeks, this condition is described as acute rhinitis and typically results from a cold or other infection, or temporary exposure to environmental chemicals or pollutants.

Allergic r. is caused by "allergens" which are the triggers for allergies. Allergens can be found indoors or outside. Allergic rhinitis is caused by outdoor allergens. These symptoms are referred to as seasonal allergies.

Chronic r. If the condition lasts for a longer period, the condition is called chronic rhinitis. Chronic Rhinitis often stems from indoor and outdoor allergies, but can also be caused by structural problems in the nasal septum or chronic infections.

Sarcoidous r. A tuberculous infection of the nasal mucous membrane.

Vasomotor r. is a form of chronic nonallergic Rhinitis and occurs when the nasal membrane swells in response to irritants such as smoke, environmental toxins or stress.

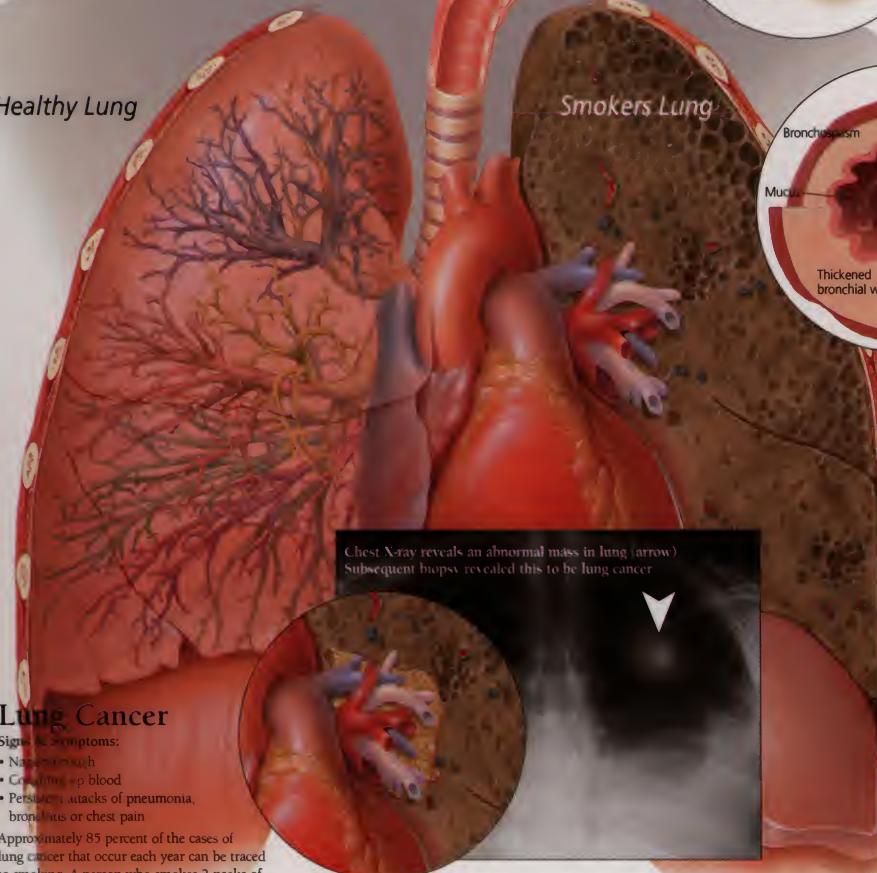


The Effects of Smoking

The Dangers of Smoking

Smoking is the most preventable cause of death in our society. It is responsible for almost 90 percent of all deaths from lung cancer and for about 30 percent of all cancer deaths. Smoking also contributes substantially to the development of atherosclerosis, which affects the heart and other gastrointestinal related disorders. Cigarette smoke contains more than 4000 chemicals, including trace amounts of such known poisons as cyanide, arsenic and formaldehyde. There are 43 known cancer causing chemicals in tobacco smoke. Use of smokeless tobacco increases the risk of disease and/or cancer of the mouth, sinuses, area, larynx, throat, or esophagus.

Healthy Lung



Lung Cancer

Signs & Symptoms:

- Nausea or cough
- Coughing up blood
- Persistent attacks of pneumonia, bronchitis or chest pain

Approximately 85 percent of the cases of lung cancer that occur each year can be traced to smoking. A person who smokes 2 packs of cigarettes or more daily for 20 years has a 60 to 70 fold increased risk of cancer compared to a nonsmoker. The risk of lung cancer increases with the number of cigarettes that are smoked each day, the number of years smoked, the amount of smoke that is inhaled and the amount of tar and nicotine in the cigarettes that are smoked.



Cancer of the Esophagus

Signs & Symptoms:

- Difficulty in swallowing
- Chest pain or discomfort
- Weight loss

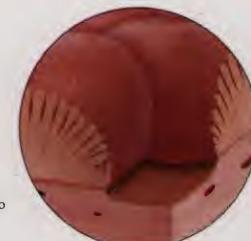
Tobacco use can cause esophageal cancer by damaging the structure of cells that line the inside of the esophagus. The longer a person uses tobacco the higher the risk.

Gastric Ulcers

Signs & Symptoms:

- Gnawing or burning pain in the abdomen
- Nausea, vomiting
- Loss of appetite and weight

The effects of prolonged exposure to smoking contribute to a buildup of stomach acids that erode the protective lining of the stomach. Gnawing or burning pain in the abdomen between the breastbone and the navel is the most common symptom often occurring between meals and in the early hours of the morning. The pain can last for anything from a few minutes to a few hours and may be relieved by eating or by taking antacids. Smoking slows the healing of existing ulcers and also contributes to ulcer recurrence.



Stomach Cancer

Stomach cancer does not usually produce symptoms in the early stages of its development. It is known that stomach cancer can develop from the symptoms of gastric ulcers, and that excessive smoking increases a person's risk of developing the disease.

Other GI diseases

Smoking has also been indicated as a risk factor for Crohn's disease and possibly gallstones.

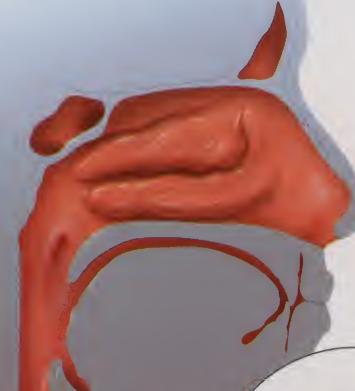


Bladder Cancer

Signs & Symptoms:

- Blood in the urine
- Pelvic pain
- Difficulty in voiding urine

Bladder cancer is prevalent among smokers over 40. Men are 4 times more likely than women to get bladder cancer. The presence of blood in the urine without pain or discomfort is the most common early symptom.



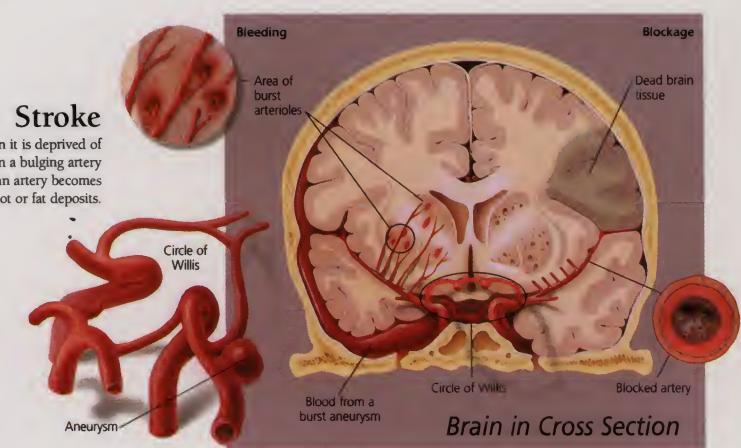
Oral Cancer

Oral Cancer is most common in people who use either tobacco or alcohol. Most oral cancers occur along the side or on the bottom of the tongue or on the floor of the mouth.

Signs & Symptoms:

- Small, pale lump or discolored thickening on the tongue, mouth, cheeks, gums or palate.

Primary cancer
Metastatic cancer



Stroke

A portion of brain tissue dies when it is deprived of blood supply. This can happen when a bulging artery (called an aneurysm) ruptures or an artery becomes blocked by a blood clot or fat deposits.

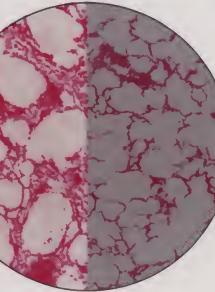
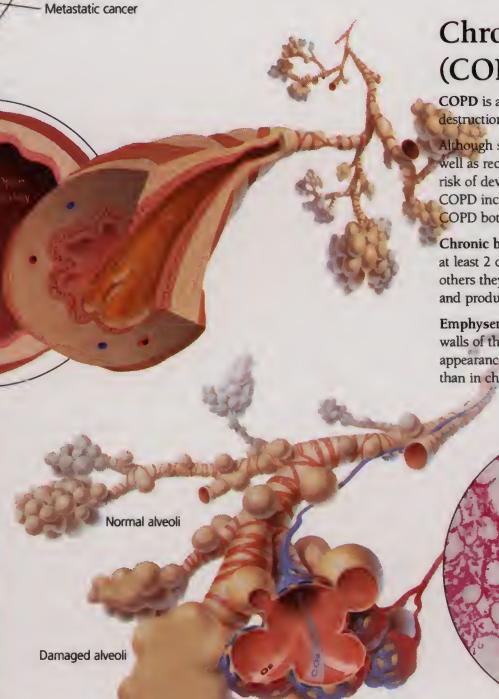
Chronic Obstructive Pulmonary Disease (COPD)

COPD is a chronic disease of the lungs that is characterized by a progressive narrowing and destruction of the bronchial tree and the airway sacs (alveoli).

Although smoking is the primary cause of COPD, chronic inhalation of fumes, dusts or chemicals as well as recurrent chest infections in childhood can also contribute. Some individuals have a higher risk of developing COPD because they have a genetic defect called alpha 1 antitrypsin deficiency. COPD includes two major disorders: chronic bronchitis and emphysema. In most patients with COPD both disorders coexist.

Chronic bronchitis is characterized by cough and sputum which is present mainly in winter over at least 2 consecutive years. In some patients cough and sputum are the only symptoms whereas in others they also complain of difficulty in breathing/shortness of breath. If you have a chronic cough and produce sputum ask your doctor to check your lungs.

Emphysema is an abnormality of the airways sacs/alveoli. The tissue surrounding the sacs and the walls of the sacs are affected and become distended and look like holes in the lung (Swiss cheese appearance). Shortness of breath is the main symptom, cough can be present but to a lesser extent than in chronic bronchitis and the chest becomes distended (barrel shape).



Enlargement of lung tissue:
(left) From a normal lung.
(right) From a lung with emphysema.
In emphysema, lung tissue is destroyed, resulting in fewer and larger alveoli.

Heart Disease

Cigarette smoking is a major cause of coronary heart disease, which leads to heart attack. Smokers have a greater risk of developing chronic disorders such as atherosclerosis (clogged arteries) and other damaging effects to the cardiovascular system. Smoking increases the risk of coronary heart disease by itself and by acting with other risk factors to greatly increase risk. The nicotine and carbon monoxide in cigarette smoke prevent the effective release of oxygen into the blood stream damaging the cardiovascular system in many ways.

Damage to the Heart

Heart disease leading to heart attack:

Fat deposits and blockages form in the arteries that supply the heart with blood.

Congestive heart failure:

Heart becomes damaged and enlarged from working so hard to pump blood against the higher blood pressure.



Women's Health Issues:

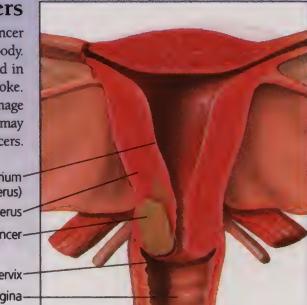
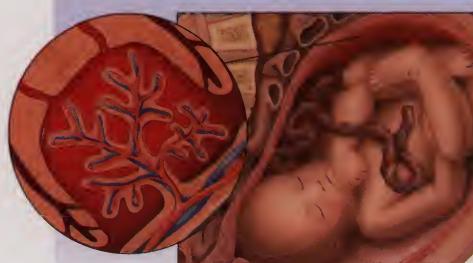
Risk factors and Pregnancy

Using tobacco increases a woman's risk of chronic health problems including pulmonary complications and premature death. Studies suggest that cigarette smoking dramatically increases the risk of heart disease among premenopausal women who are also taking birth control pills. Studies show that mothers who smoke a pack or more of cigarettes a day consistently produce smaller babies than non-smokers. The carbon monoxide inhaled with cigarette smoke reaches the fetus and diminishes its ability to absorb oxygen, resulting in significant oxygen deprivation. Other complications include decreased blood flow which diminishes the transfer of essential nutrients from mother to fetus. A small baby is generally weaker and more vulnerable to illness than one of average size. Smokers are more apt to have their pregnancy end in premature birth, miscarriage or stillbirth. Research also suggests that infants are more likely to die from Sudden Infant Death Syndrome (SIDS) if their mothers smoke during and after pregnancy.

Cancers

Smoking exposes the body to many cancer causing chemicals that flow through the body.

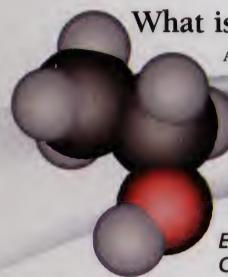
Tobacco by products have been found in the cervical mucus in women who smoke. Researchers believe these substances damage the structure of the cells in the cervix and may contribute to the development of cancers.



Enlargement of placenta tissue:
Nicotine stimulates the release of hormones that constrict the vessels supplying blood to the placenta and uterus, diminishing the transfer of essential nutrients from mother to fetus.



The Effects of Alcohol



What is alcohol?

Alcoholic beverages contain ethanol, a clear, thin, odorless liquid created by the fermentation of fruit or grain mixtures (wine and beer) or the distillation of fermented fruit or grain mixtures (whiskey, gin, vodka, and rum). The exact concentration of ethanol varies according to the type of beverage. On average, beer is 4.5 percent ethanol; wine is 11 percent ethanol; and distilled spirits range from 40 to 95 percent ethanol. Pure alcohol should never be consumed as it quickly produces effects that can become fatal.

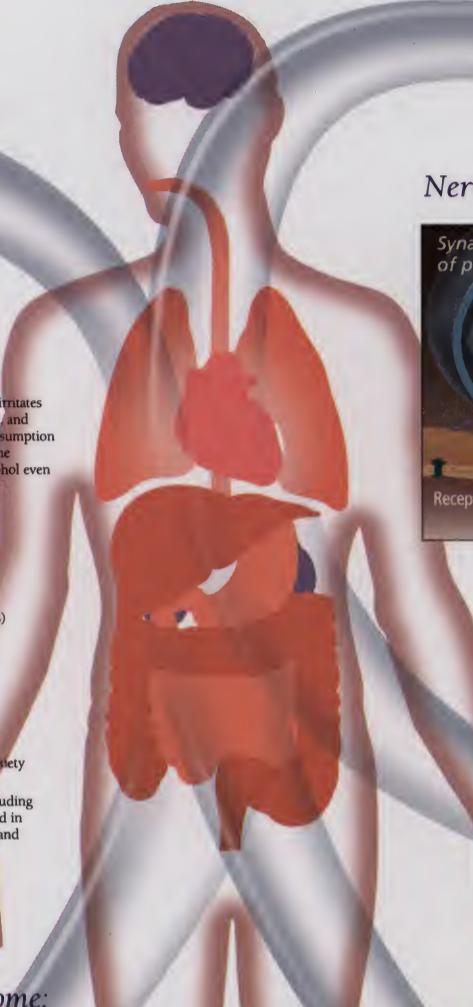
How alcohol affects the body

Alcohol affects virtually every part of the body. In the gastrointestinal system, alcohol irritates the linings of the esophagus and stomach, triggers the secretion of acid and histamine, and can cause vomiting. Over time, alcohol use can lead to gastritis or ulcers. Alcohol consumption also increases blood flow to the skin, resulting in lost body heat, while at the same time decreasing blood flow to the muscles. Brain and liver cells are directly affected by alcohol even with occasional drinking.

Long-term effects of heavy drinking include more serious complications such as:

- Liver enlargement and damage such as alcoholic hepatitis and cirrhosis
- High blood pressure, stroke, irregular heartbeat, and heart damage or disease
- Kidney failure resulting from chronic alcohol-induced diuresis
- Increased risk of mouth, larynx, liver and gastrointestinal cancers
- Greater incidence of pneumonia and acute respiratory distress syndrome (ARDS)
- Dietary deficiencies of essential nutrients such as iron, folic acid, and thiamine, which may lead to nerve damage
- Impairment of memory, thinking, and concentration skills
- Death of brain cells and reduced brain mass
- Higher risk of injury from falls or accidents
- Decreased production of sex hormones
- Personality changes and other emotional and behavioral problems including anxiety or depression

Acute overdoses of alcohol, also known as alcohol poisoning, produce symptoms including nausea and vomiting, loss of consciousness, depressed respiration, lack of reflexes, and in severe cases, coma. Blood alcohol concentrations above .40-.50 are considered lethal and may be fatal if not treated immediately.



Fetal Alcohol Syndrome:

Alcohol in a pregnant woman's bloodstream is passed directly through the placenta and into the developing baby's bloodstream. High alcohol consumption by a pregnant mother can cause fetal alcohol syndrome, which is associated with:

- Mental retardation and developmental delays
- Small body size, slow growth and poor coordination
- Heart defects
- Hearing, vision, and dental defects
- Facial abnormalities
- Behavioral problems including hyperactivity and limited attention span

Drinking alcohol during pregnancy also increases the risks of miscarriage, still birth, and low birth weight.



Cross section of liver lobule with later stages of fibrosis, scar tissue



Cirrhosis of the liver:

Chronic heavy drinking can cause alcoholic hepatitis, cirrhosis, or complete liver failure. Cirrhosis develops when a significant portion of liver tissue is progressively and irreversibly destroyed by alcohol abuse.



Kidney Effects:

The kidneys have several functions, including elimination of cellular waste products, regulation of fluid and electrolyte volumes and concentrations, and production of hormones. Alcohol can compromise the functioning of the kidneys in several ways. Through its ability to increase urine volume, alcohol alters the body's fluid level, which changes the electrolyte balance. The effects of this imbalance vary, but can include dehydration and impaired mental activity. Brain cells, particularly neurons, are highly affected by the electrolyte balance. Alcohol also disrupts the hormonal regulation of the kidney through changes in plasma volume and blood pressure. Impairment of liver function from alcohol can result in compromised kidney function, such as impaired fluid handling.

Intoxication levels

The degree of alcohol intoxication depends on multiple factors, including body size, the amount and rate of alcohol consumption, the rate of absorption (influenced by the presence or absence of food in the stomach), how the body metabolizes alcohol, genetics, and previous drinking experience. As a general rule, alcohol that is consumed slowly (7 grams per hour or approximately 1.5 ounces of 80% proof distilled spirits) will not accumulate in the body or result in intoxication.

BAC*	Effects
.01 - .05 %	Feelings of relaxation, lowered inhibitions
.05 - .07 %	Impairment begins, loss of coordination, reflexes, and muscle control, loss of self-control, and driving capability
.08 - .10 %	Legally drunk in almost all states and the District of Columbia
.10 - .15 %	Loss of balance, impaired body coordination and slightly slurred speech
.15 - .25 %	Slurred speech, difficulty walking, confusion, loss of perception, vision problems
.25 - .40 %	Most people are in a state of stupor; loss of consciousness, some may die
.40 - .50 + %	Most people are unconscious, breathing shuts off; coma and death are likely.

*Approximate Blood Alcohol Concentration

What is alcoholism?

Alcoholism or alcohol dependence is a disease that is usually chronic and progressive and frequently fatal. Symptoms of alcoholism include:

- Emotional and physical dependence on alcohol
- Blackouts and hangovers
- Alcohol-related health problems
- Unpleasant withdrawal symptoms.

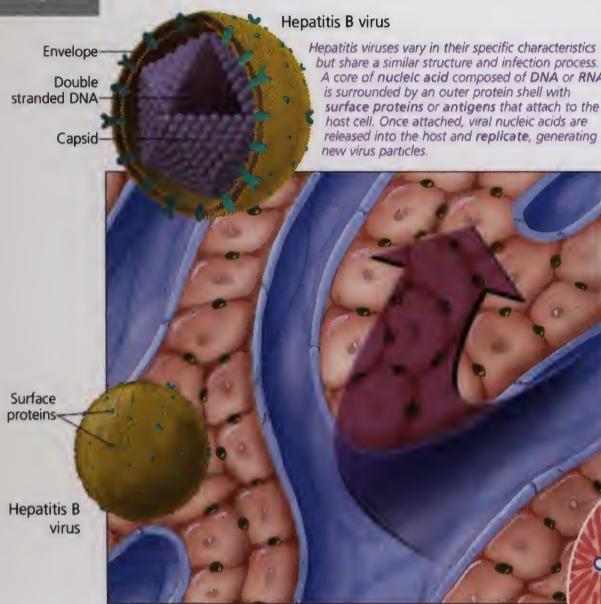
Alcohol dependence can take many forms, ranging from occasional drinking to chronic heavy drinking or binge drinking. Most people with alcohol dependence continue to drink even if alcohol is affecting their physical or mental health. Many alcoholics need increasing amounts of alcohol to become intoxicated and experience severe withdrawal symptoms during periods of abstinence. They may also have poor nutrition, gastrointestinal problems, numbness or weakness in the legs and hands and problems with balance.

Treatment

The first step in treatment is acknowledgement of a drinking problem and a decision to stop drinking. Depending on the severity of the disease, either inpatient or outpatient detoxification may be necessary to help the body reverse its dependence on alcohol. Medical treatment may also include tranquilizers, vitamin supplements and intravenous fluids. Drugs such as disulfiram and naltrexone are sometimes prescribed to reduce the craving for alcohol. Other important components of alcoholism treatment include long-term psychological counseling, self-help groups, and counseling for family members.



Understanding Hepatitis



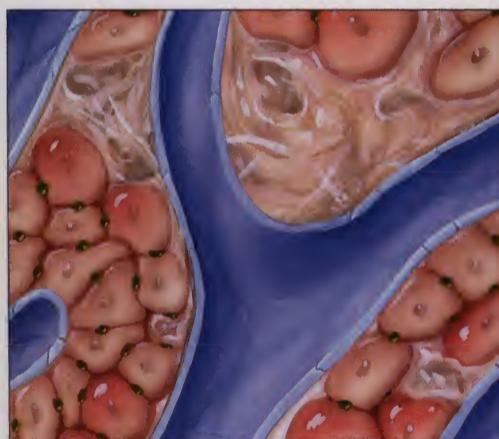
Infection

is the first stage of hepatitis and occurs when the virus enters the body and invades the liver cells, prompting antibody response. Length of incubation time varies according to the type of virus.



Inflammation

occurs when the immune system responds to infection, causing injury or destruction in the infected liver cells. Inflammation can also result from exposure to drugs, alcohol, and other substances.



Fibrosis

is the growth of scar tissue following infection, inflammation, or injury to the liver. Over time, scar tissue can inhibit normal liver function, including blood processing and nutrient metabolism.



Cirrhosis
develops when a significant portion of the liver tissue has been progressively and irreversibly destroyed by injury or disease. Cirrhosis may result from alcohol abuse, chronic viral liver disease, or other causes and is often fatal.

What is hepatitis?

Hepatitis is an inflammation of the liver triggered by infection or injury and characterized by the destruction of significant numbers of liver cells. The severity of the disease depends on many factors, including the specific cause of the inflammation as well as any preexisting physical conditions. The symptoms vary widely according to the type of hepatitis and the duration of the inflammation (acute or chronic).

Acute hepatitis

The acute form of hepatitis evolves over a short period of time and resolves within 6 months (often 2 months or less). It may be caused by a variety of factors, including hepatitis viruses, medications, toxins, and severe bacterial infections.

Chronic hepatitis

Acute hepatitis that persists for more than 6 months is called chronic hepatitis. There are many potential causes of chronic hepatitis, including infection by hepatitis viruses B and C. Chronic hepatitis can result in persistent liver damage.

Causes of hepatitis

Hepatitis can be caused by any substance or organism that damages the liver, including viruses, autoimmune disorders, alcohol, drugs, and chemical toxins.

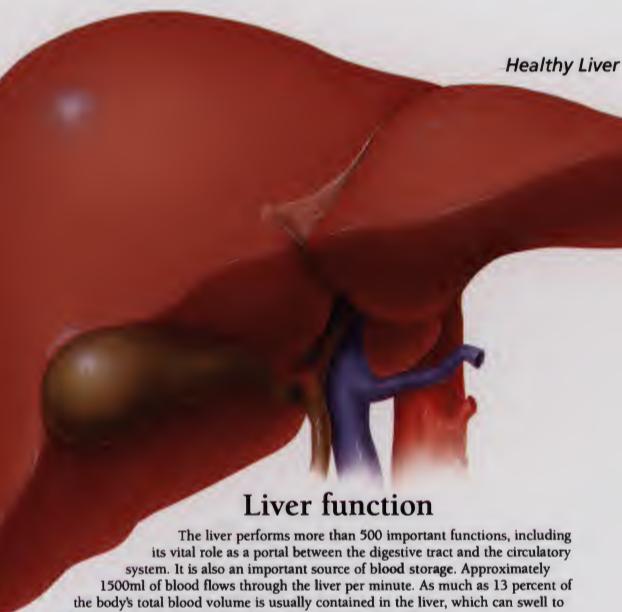
Viral hepatitis is the leading cause of liver disease in the United States. Symptoms of acute viral hepatitis may begin suddenly or develop over time. They often include nausea and vomiting, slight fever, fatigue, and pressure or pain in the upper right abdomen. Jaundice, dark-colored urine, joint aches, diarrhea, and weight loss may also occur.

Autoimmune hepatitis occurs when the body's defense mechanisms attack the liver cells. It can be present in either chronic or acute form and may appear similar to viral hepatitis. Fatigue is the most common symptom, but other symptoms, ranging from mild to severe, can include enlarged liver, jaundice, and joint pain as well as itching and skin rashes. Autoimmune hepatitis is more common in women than men and may be associated with other autoimmune disorders.

Alcohol and drug hepatitis results from excessive or chronic alcohol use or following the consumption of certain drugs or medications. Symptoms include jaundice, fatigue, and alterations in sense of taste and smell. Alcoholic hepatitis may produce symptoms ranging from mild flu-like characteristics to high fever and enlarged liver. If untreated, this condition can lead to fatty liver, cirrhosis, or complete liver failure. Toxic and drug-induced hepatitis can be caused by a variety of prescription and over-the-counter medications as well as chemical agents and industrial toxins.

Nonalcoholic steatohepatitis can appear in patients with conditions including high cholesterol, diabetes, and obesity who do not consume large amounts of alcohol. Symptoms are similar to alcohol-induced hepatitis.

Healthy cross section of liver lobule



Healthy Liver

Liver function

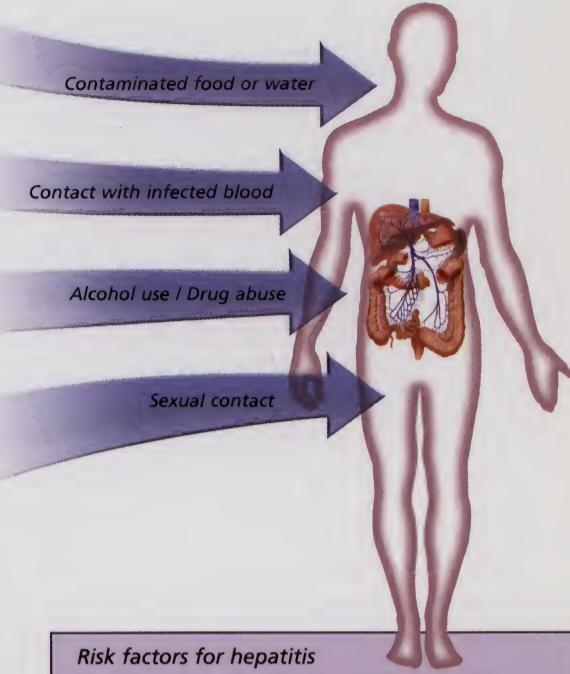
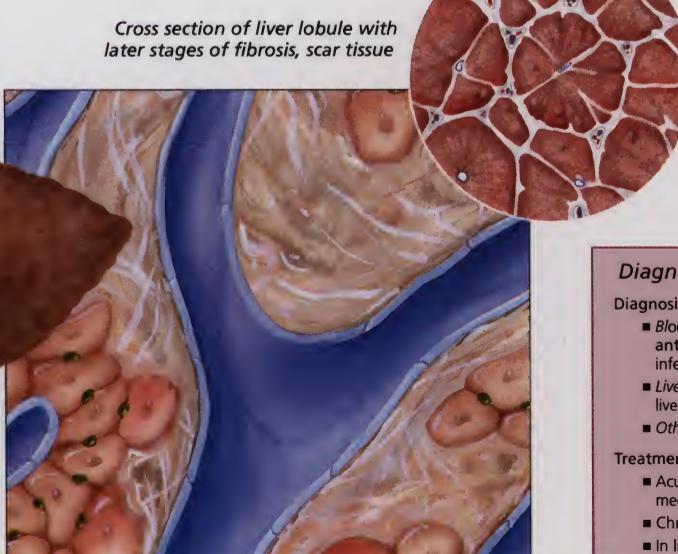
The liver performs more than 500 important functions, including its vital role as a portal between the digestive tract and the circulatory system. It is also an important source of blood storage. Approximately 1500ml of blood flows through the liver per minute. As much as 13 percent of the body's total blood volume is usually contained in the liver, which can swell to hold even larger amounts of blood in response to injury or illness.

What is portal hypertension?

Portal hypertension is an increase in pressure in the portal vein that carries blood from the intestines, spleen, and pancreas into the liver.

- In cirrhosis, damage from fibrosis can increase resistance in the portal vein, forcing blood to flow back towards the heart by the way of collateral vessels, instead of through the liver.
- Collateral vessels may develop to bypass the liver, connecting the portal vein directly to the lower portion of the esophagus.
- Swollen collateral vessels (esophageal varices) are fragile and can easily rupture, causing dangerous bleeding in the stomach.

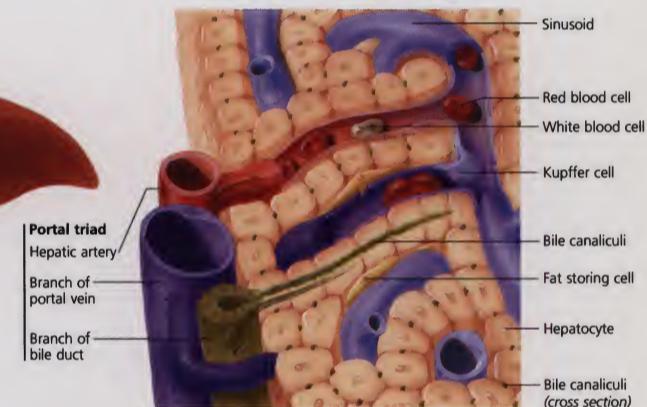
Cross section of liver lobule with later stages of fibrosis, scar tissue



Risk factors for hepatitis

- Exchange of bodily fluids with an infected person, especially through sexual contact or sex with multiple partners
- Consumption of contaminated water or food, including improperly cooked shellfish (HAV)
- Contact with infected blood through illicit drug use or occupational needle sticks
- Sharing razors, toothbrushes or other personal items that may contain blood
- Chronic or excessive alcohol use and drug abuse

Enlarged view of the liver lobule



Types of hepatitis

There are six recognized viruses that can cause viral hepatitis.

HAV

Hepatitis A Virus is an acute form of hepatitis virus that typically begins 2-6 weeks after infection. It is easily spread through food or water contaminated by the feces of an infected person or through contaminated shellfish. HAV usually requires no treatment and resolves over several weeks, although up to 15% of patients will have prolonged symptoms over a 6-9 month period. HAV can be prevented with Hepatitis A vaccine.

HBV

Hepatitis B Virus can cause both acute and chronic hepatitis. Symptoms appear within 1-6 months after infection and may be almost unnoticeable or produce a range of typical viral hepatitis symptoms lasting several weeks or months. HBV is extremely infectious and spreads through body fluids, contaminated syringes and needles, or transmission from mother to unborn child. HBV can be prevented with Hepatitis B vaccine.

HCV

Hepatitis C Virus causes both acute and chronic hepatitis; it is much more likely to produce chronic liver disease than Hepatitis B. Up to 80% of patients have no signs or symptoms of disease, which develop between 2 weeks and 6 months after infection. The chronic form can also develop without early symptoms, although liver damage is occurring. HCV is spread mainly through contact with infected blood, including IV drug use, needle sticks, and unprotected sexual contact. There is no vaccine for HCV.

HDV

Hepatitis D or Delta Virus occurs only in conjunction with Hepatitis B Virus and spreads through similar routes. Acute infection can be more severe if both viruses are present, although complete recovery usually occurs when infection with both viruses occurs simultaneously (coinfection). Patients who develop chronic Hepatitis B and are later infected with HDV (superinfection) experience more severe symptoms and are more likely to develop liver failure. HDV can be prevented with Hepatitis B vaccine.

HEV

Hepatitis E Virus produces acute hepatitis symptoms and is transmitted via ingestion. It is prevalent in developing countries where water sources are contaminated by human waste. Symptoms develop within 2-8 weeks and resolve completely within a month. Pregnant women are at greatest risk from severe illness or acute liver failure. There is no vaccine for HEV.

HGV

Hepatitis G Virus is a recently discovered viral form that may occur alone or in the presence of HBV or HCV. Little is known about the course of illness but research suggests that it is mild and short-term. GBV has also been identified in patients with chronic viral hepatitis. It is transmitted via the blood and there is no vaccine.

Diagnosis and Treatment

Diagnosis is confirmed with clinical tests. Symptoms are also important but may not be present in all patients.

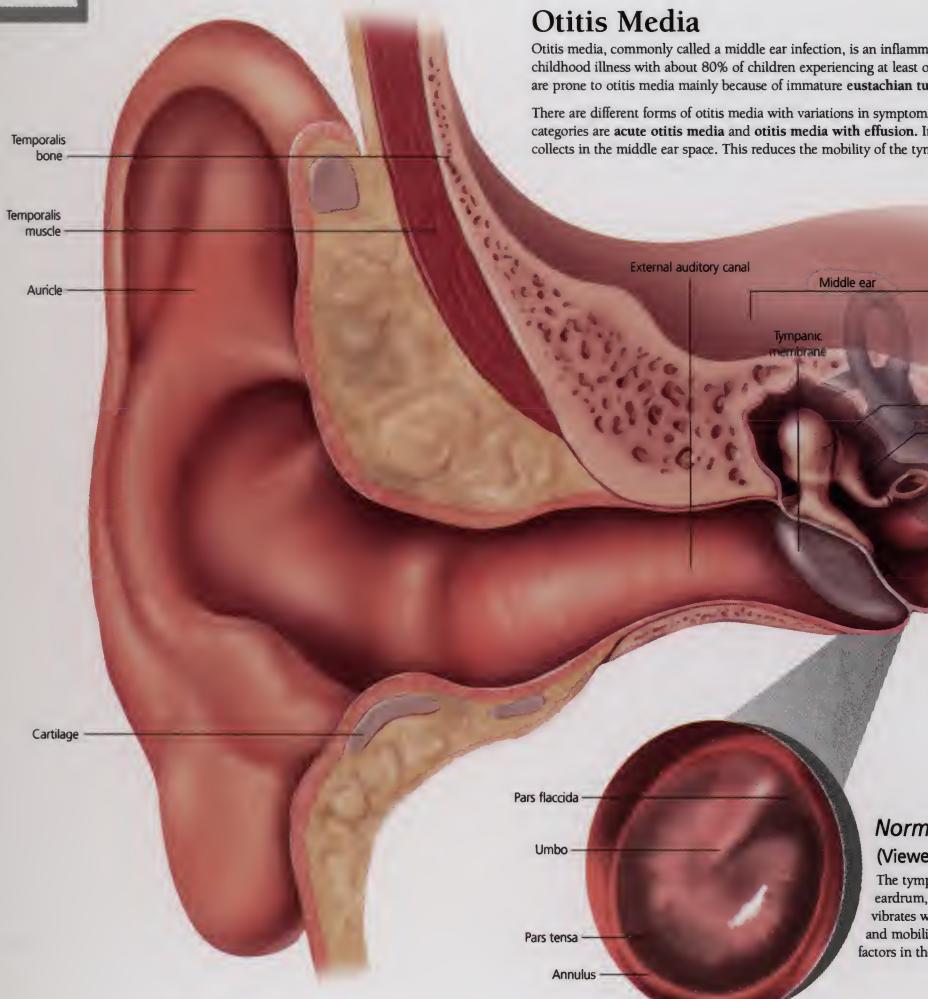
- Blood tests measure elevated bilirubin and aminotransferase levels and the presence of antigens and antibodies that develop during viral infection. After recovery, antibodies may remain, indicating previous infection. Immune factors (serum globulins) in the blood may help diagnose autoimmune hepatitis.
- Liver biopsy is required to confirm chronic hepatitis and determine the type and degree of damage from liver disease.
- Other tests such as ultrasound and liver/spleen scans may be used to diagnose cirrhosis.

Treatment varies depending on the type and severity of disease.

- Acute infections are typically treated with rest, a balanced diet, and abstinence from alcohol or certain medications that are metabolized in the liver.
- Chronic hepatitis treatment may include interferon and/or other specialized drugs.
- In liver failure, transplantation is the only treatment option.



Middle Ear Infections



Otitis Media

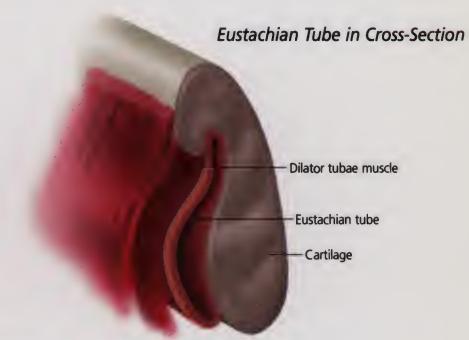
Otitis media, commonly called a middle ear infection, is an inflammation of the **middle ear**. Otitis media is a common childhood illness with about 80% of children experiencing at least one episode by the age of four. Children and infants are prone to otitis media mainly because of immature **eustachian tubes** and immune systems.

There are different forms of otitis media with variations in symptoms, duration and treatments. The two most common categories are **acute otitis media** and **otitis media with effusion**. In both conditions, fluid, called effusion, usually collects in the middle ear space. This reduces the mobility of the tympanic membrane, often impairing hearing.



Middle Ear

The middle ear is a small, air-filled cavity located behind the tympanic membrane that contains tiny bones called ossicles. The middle ear is connected to the respiratory system by the eustachian tube. The mucosal lining of the respiratory system is continuous with the lining of the eustachian tube and middle ear. This connection makes the middle ear susceptible to respiratory system inflammation and infection.



Eustachian Tube in Cross-Section

Normal Tympanic Membrane (Viewed from External Auditory Canal)

The tympanic membrane, commonly known as the eardrum, is a thin, semi-transparent membrane that vibrates when struck by sound waves. The appearance and mobility of the tympanic membrane are important factors in the diagnosis of otitis media.

Acute Otitis Media

Acute otitis media is a painful middle ear inflammation in which effusion collects in the middle ear. It is characterized by a rapid onset of the symptoms of acute infection. The infection is usually caused by bacteria, although it can be viral.

Acute otitis media often follows an upper respiratory tract infection. Bacteria in the middle ear can proliferate in the effusion or can be aspirated into the middle ear from the nasopharynx.

If middle ear effusion persists for more than three months after an episode of acute otitis media, the condition becomes **chronic otitis media with effusion**.

Symptoms

Earache
Fever
Hearing loss
Discharge from ear
Nausea and Vomiting
Diarrhea
Loss of appetite
Irritability



Otitis Media with Effusion

Otitis media with effusion is an inflammatory condition in which fluid collects in the middle ear, but there are no symptoms of acute infection. Otitis media can occur in conjunction with an upper respiratory tract infection, after an episode of acute otitis media, or independent of other illnesses. Bacteria may or may not be present in the effusion.

Otitis media with effusion differs from acute otitis media in that it is generally a painless condition. For this reason, otitis media with effusion may be present for a long time before being diagnosed.

Otitis media with effusion often resolves spontaneously without treatment. If the effusion fails to resolve after a reasonable amount of time, surgical management may be indicated.

Symptoms

Otitis media with effusion can be asymptomatic, but if symptoms are present, they are often vague. Mild to moderate hearing loss and a feeling of fullness or ringing in the ear are most common.

Treatments

The treatment of otitis media varies according to the type, severity and duration of the condition. Sometimes active treatments are not necessary, and watchful waiting is the most appropriate course of action.

Antibiotics

Your doctor will often prescribe a course of antibiotics to eliminate any bacterial infection in the middle ear or respiratory system. There are currently a new series of vaccines for preventing the most common causes of middle ear infections.

Surgical Management

Myringotomy and tympanostomy tube insertion can be used to ventilate and drain an effusion in the middle ear. The myringotomy can be performed as a separate procedure or in conjunction with the insertion of a tympanostomy tube.



Myringotomy
An incision made in the tympanic membrane.

Tympanostomy Tube
A tympanostomy tube is inserted into the incision.



Tympanic Membrane

■ Thickens and becomes opaque
■ Appears full or bulging
■ Lacks mobility

Ruptured Tympanic Membrane



As a result of pressure effusion from acute otitis media in the middle ear, the tympanic membrane can spontaneously rupture. This opening allows drainage of fluid or pus from the middle ear into the external auditory canal and eustachian tube. The perforation generally closes within 3 weeks.



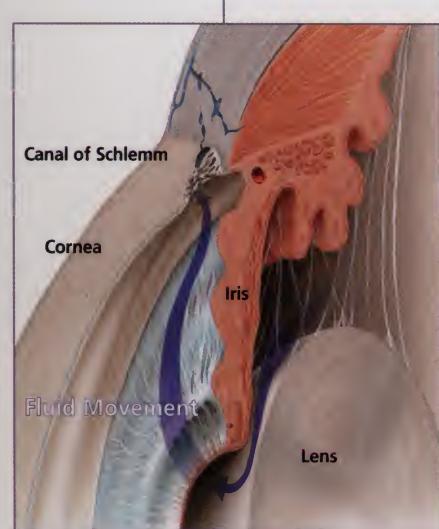
Understanding Glaucoma

What is Glaucoma?

Glaucoma is a group of diseases in which the normal pressure of the fluid inside the eyes (intraocular pressure) is increased. This can lead to loss of vision and, possibly, to blindness if the condition is left untreated. Glaucoma affects about 1 in 20 people at the age of 70 years. It is more common and may be more severe in black people and in people with a family history of the disease. The most common form of the disease is open angle glaucoma, which affects about two-thirds of glaucoma sufferers.

There is a small space at the front of the eye called the **anterior chamber**. The **ciliary body** supports the lens and produces a watery fluid, the **aqueous humour**, which bathes and nourishes the neighboring tissues. The aqueous humour is drained constantly through a spongy mesh that lies in the angle between the **iris** and the inner surface of the **cornea**. The fluid drains too slowly in people with open angle glaucoma. This causes the intraocular pressure to increase and the cornea to swell. These changes can result in damage to the **optic nerve**. The optic nerve connects the light-sensitive **retina** to the brain and any damage to it can result in defects in vision.

At first, people with glaucoma are free of symptoms. Vision is normal and there is no pain associated with the condition. As the disease progresses, people may have difficulty moving from a bright room into a darker one and in judging steps and curbs. A person with glaucoma may continue to see objects directly in front of him clearly. However, objects to the side (periphery) may be missed. Blindness can result from a progressive loss of visual field if the disease remains untreated.



The Cause of Glaucoma

Fluid normally passes through a narrow space between the iris and lens, then drains out of the eye through the **Canal of Schlemm**. If this outward flow is blocked, pressure can damage the optic nerve and reduce vision.

How is Glaucoma Diagnosed?

Glaucoma is a chronic disease that develops slowly. Damage to the optic nerve and visual loss have developed in many patients before the condition has been diagnosed. Regular eye examinations are essential in people who are at risk of developing glaucoma and in those who have been diagnosed with the disease.

A range of tests are used to diagnose and monitor glaucoma.

Visual acuity

The ability of the person to see at various distances is measured using eye charts. These usually consist of letters of different sizes against a plain background.

Tonometry

It has been known for over 100 years that the assessment of intraocular pressure is important in the diagnosis and monitoring of glaucoma. However, it has been recognized more recently that there is no cut off point between normal and raised intraocular pressure. High intraocular pressure increases a person's risk of developing glaucoma but it does not mean that the person has the disease. The development of glaucoma in an individual depends upon the level of intraocular pressure that the optic nerve will tolerate.



Applanation Tonometer

Tonometry is a term used to describe the methods of measuring intraocular pressure. There are many different types of tonometry. The Goldmann applanation tonometer subjects the eye to sufficient force to flatten the cornea. The force applied is measured using a cobalt blue light source and is related to the intraocular pressure by a mathematical equation.

Another type of tonometry relates the time required to flatten the cornea using a puff of air to the intraocular pressure. This method is useful in screening people for glaucoma.

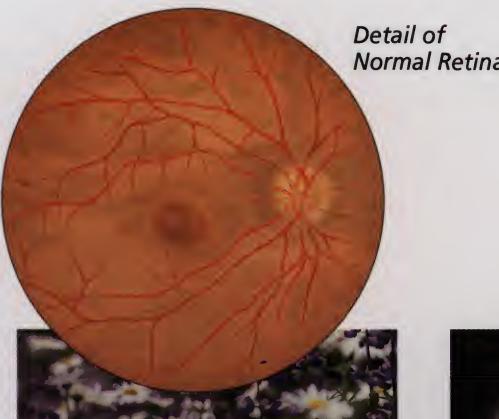
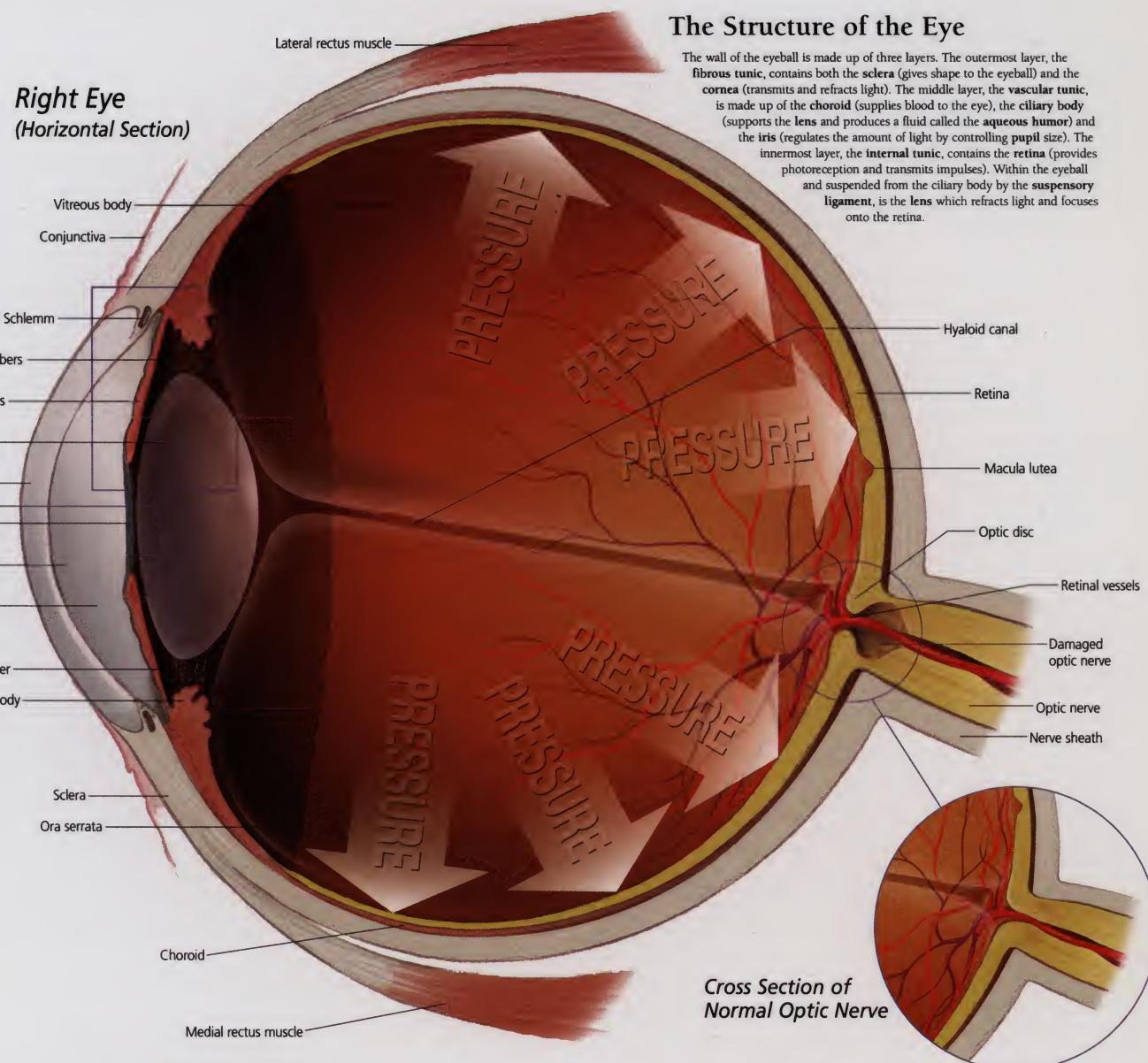
Pupil dilation

Drops are put into the eye to widen the pupil. This allows signs of damage to the optic nerve to be observed more easily.

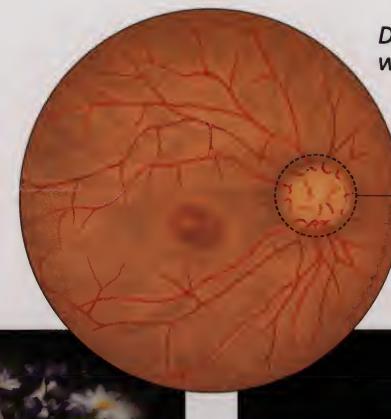
Visual field

Peripheral vision is measured using the technique of perimetry. The test involves illuminated targets being projected onto an illuminated background. The brightness of the targets is varied so that the average luminescence of the dimmest target can be calculated. The test is repeated several times within the visual field and any abnormalities are detected using a computer printout.

Perimetry is used to show the extent of any damage due to glaucoma and also to check on any progression of the disease.



Detail of Normal Retina



Detail of Retina with Glaucoma



Field of Vision Loss

The sequences of photographs suggests the progressive narrowing of the field of vision characteristic of glaucoma.

How is Glaucoma Treated?

The best way to control glaucoma is to ensure that it is detected and treated as early as possible. People who fall into high risk groups should have their eyes examined regularly. It is essential that people with glaucoma have their condition monitored at regular intervals.

Glaucoma cannot be cured but it can be corrected in most people. A variety of treatments can be used, depending on the severity of the condition.

Most people with open angle glaucoma are treated with medications. The most common initial treatment is eye drops containing a beta-blocker, such as timolol. These lower the intraocular pressure by reducing the production of aqueous humour and delay the progress of glaucoma. Some people are unable to tolerate beta-blockers or have other medical conditions that prevent their use. Dorzolamide or brinzolamide also reduce the production of aqueous humour and may be suitable for these people. They can also be used in combination with beta-blockers. Other eye drops, such as adrenaline or pilocarpine, can be added as necessary to control intraocular pressure. Apraclonidine is a drug that lowers the intraocular pressure by reducing the rate of production of aqueous humour. Latanoprost lowers the intraocular pressure by increasing the drainage of the aqueous humour from the anterior chamber.

Medication will control intraocular pressure in most people with glaucoma. However, it is essential that medication is used regularly and that glaucoma is monitored to ensure that the combination of drugs selected remains effective.

In some people, medication may not be effective in controlling glaucoma and surgical treatments have to be considered. In laser surgery, a strong beam of light is focused on the part of the anterior chamber where the aqueous humour is drained from the eye. Changes in the tissue following exposure to the laser result in improved drainage of the aqueous fluid from the eye. The effects of laser surgery may wear off with time. Medication is continued in many patients to maintain long term benefits.

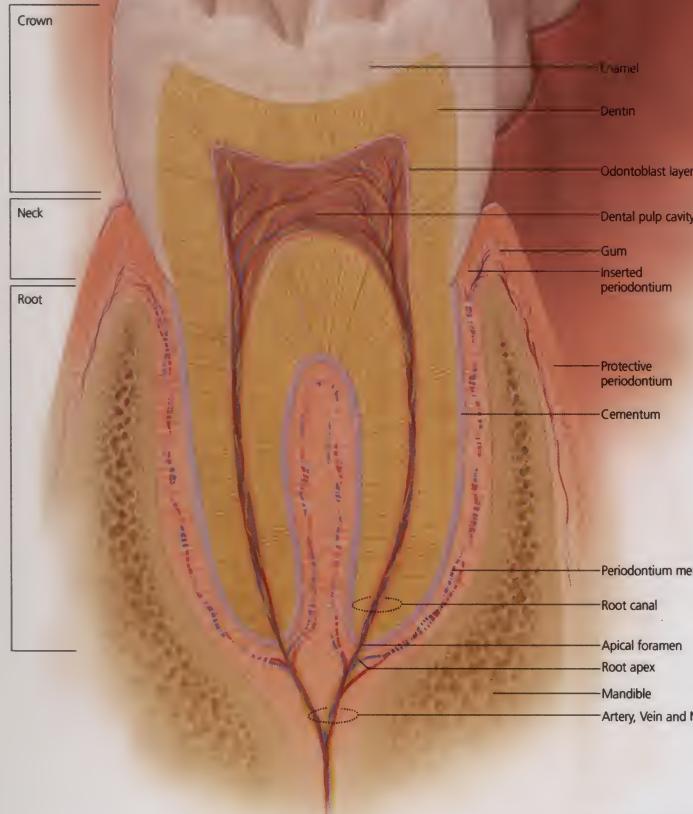
Surgery is usually reserved for people whose intraocular pressure cannot be controlled by medication or laser surgery. A channel is created in the eye so that the aqueous humour can leave the eye more easily and intraocular pressure is reduced. Medication is usually required following surgery.

Understanding the Teeth



The anatomy of the teeth

The teeth are living, calcified structures embedded in the upper (maxillary) and lower (mandibular) arches of the jaw. The part of the tooth visible above the gumline is called the crown. Below the gumline is the root, which extends into the bony portion of the jaw. The teeth are tightly surrounded by soft tissue called the gingiva (gums), and cushioned by shock-resistant periodontal membrane, which line the bony sockets within the jaw.



A tooth consists of four layers

Enamel is the white, highly calcified outer layer. It is the hardest substance in the body and highly resistant to acids and other corrosive agents. Enamel is without feeling. Dentin is a hard, yellow layer of tissue beneath the enamel that forms the bulk of the crown. It is softer than enamel and transmits sensations such as temperature and pain to the root. Cementum is a thin, bony layer covering the root portion of the tooth. It is connected to the jaw bone by collagen fibers that pass through the periodontal membrane to hold the tooth in place. Pulp is the soft tissue in the inner cavity of the tooth. It contains the nerve fibers and blood vessels and supplies nutrients to the tooth. Pulp extends into the jaw bone and is highly sensitive to pain and temperature.



Types and functions of teeth

The adult jaw holds 32 permanent teeth arranged in an arch, with 16 teeth on the upper jaw and 16 teeth on the lower. The general positions of the teeth within the mouth are noted as either anterior (towards the front) or posterior (towards the back). There are four types of permanent teeth:

ANTERIOR

Incisors

- Sharp, chiseled shape
- Located at the center front of the mouth
- Used to cut or shear food
- 2 central upper/lower, 2 lateral upper/lower

POSTERIOR

Canines

- Also called cuspids
- Shaped like points
- Work with the incisors to tear food
- Support the lips and guide jaw alignment
- 2 upper, 2 lower

Premolars

- Also called bicuspid
- Broad surfaces with pointed cusps
- Used to crush and tear food
- Support vertical dimension of the jaw and face
- 4 upper, 4 lower

Molars

- Broad surfaces with several cusps
- Important for grinding food
- Work with premolars to maintain vertical dimension
- 6 upper, 6 lower

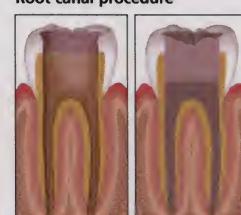
Tooth decay and treatment

Dental caries, also known as tooth decay (cavities), is primarily caused by the deposit of **plaque** on the surfaces of the teeth. Plaque consists of a thin, sticky film of **food debris**, **mucus**, and **bacteria**. Although natural protective bacteria in the saliva help protect the teeth by neutralizing acids and washing away food particles, bacterial activity in the plaque can still form erosive acids that gradually destroy the enamel of the tooth. Once a cavity begins, erosion continues into the dentin and if left untreated, to the pulp and nerve of the tooth.

Treatment

Because early tooth decay does not cause pain, **regular dental checkups** are important to detect caries before the decay spreads. Once a cavity is identified, the decayed portion of the tooth is restored with a filling and a crown, if necessary. Tooth decay that has reached the pulp will require additional treatment, such as antibiotics and root canal. (See also *Periodontal Disease*.)

Root canal procedure



Filling



Why do teeth hurt?

Pain either in one tooth or in the teeth and gums generally can occur as a sharp twinge or a dull throb.

Tooth pain during or after eating or in response to hot or cold temperatures may be caused by tooth decay, gingivitis or linked to recent dental work.

Repeated episodes of throbbing pain are usually associated with advanced tooth decay/inflammation of the pulp (pulpitis).

Continuous pain and/or elevated temperature result from severe pulpitis or an abscess in the pulp or root canal.

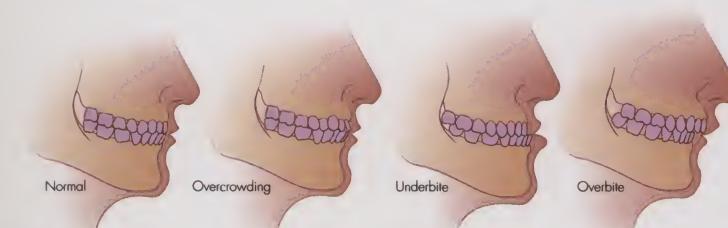
Impaction

Teeth become impacted when they remain **embedded in the gum (gingiva) or bone** and either fail to emerge or emerge only partially. Impaction occurs when a tooth is **blocked by other teeth**, because the **jaw is too small** or if teeth become tilted or twisted as they emerge. The most common type of impaction is in the wisdom teeth, or third molars. Symptoms may include pain in the gum or jaw, inflammation in the gum around the tooth cause by trapped debris (pericoronitis) and prolonged headache or jaw ache. Pressure from impacted teeth may also cause **misalignment** in nearby teeth. Extraction is usually recommended for symptomatic impactions.



Horizontal

Mesioangular



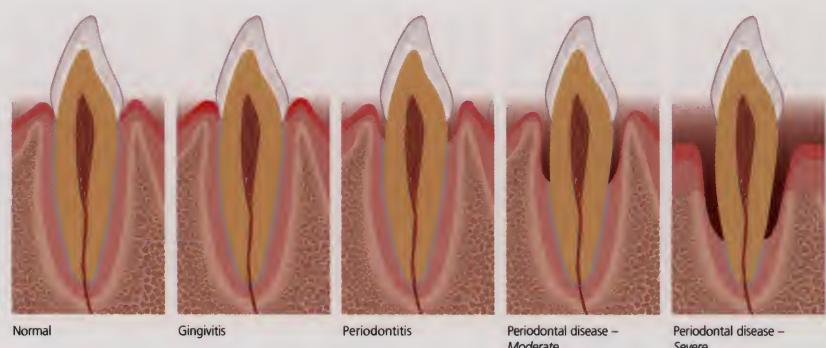
Occlusion

The alignment of the upper and lower jaws and surfaces of the teeth is called occlusion (or bite). In many people, occlusion abnormalities (malocclusion) occur as a result of disproportionate teeth and jaw size, extra teeth, tooth loss, trauma, and other factors. Surgery and/or orthodontic treatment may be necessary to reposition and align the teeth.

Types of malocclusion Type 1: Overcrowding or poor positioning of the teeth. Type 2: Overbite (upper jaw overlapping the lower). Type 3: Underbite (protruding lower jaw and teeth).

Periodontal disease

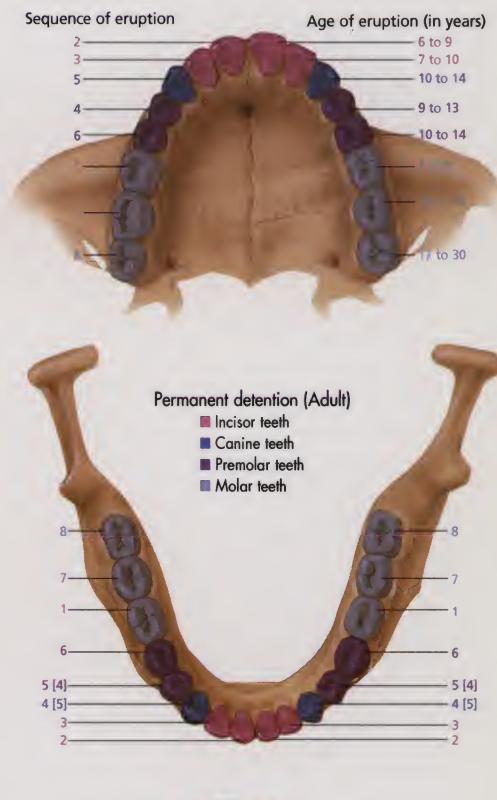
Periodontitis is an inflammation of the periodontal ligaments, gingiva, cementum and bone. It is the leading cause of tooth loss in adults and usually occurs as a result of untreated **gingivitis** (infection and inflammation of the gums). Pockets of plaque and tartar (calculus) develop around the base of the teeth and become trapped, resulting in continued inflammation that eventually destroys bone and gum tissue holding the teeth in place. Symptoms include **swollen, bright red and/or shiny gums that bleed easily, gum tenderness or pain, and loose teeth**. Treatment involves extensive cleaning to remove deposits (scaling) and/or surgery to support weakened teeth or remove damaged teeth.



Deciduous dentition

Deciduous (baby) teeth are the first, temporary set of teeth. Beginning with the lower incisors, deciduous teeth typically erupt between the ages of 6 and 24 months. There are 20 deciduous teeth (10 upper and 10 lower), which remain in place until they are shed and replaced by the permanent (adult) teeth beginning around age 6, during a process known as exfoliation. By age 13, baby teeth are usually completely replaced by permanent teeth.

Healthy baby teeth play a key role in a child's ability to form clear speech, chew efficiently, and develop normal jaw structure and facial characteristics. Extensive decay or tooth loss can have lasting effects on the appearance and development of the child's permanent teeth.



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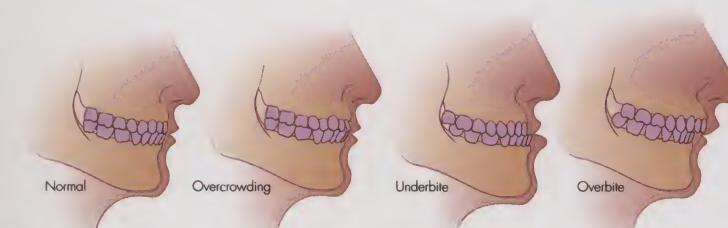
Impaction

Teeth become impacted when they remain **embedded in the gum (gingiva) or bone** and either fail to emerge or emerge only partially. Impaction occurs when a tooth is **blocked by other teeth**, because the **jaw is too small** or if teeth become tilted or twisted as they emerge. The most common type of impaction is in the wisdom teeth, or third molars. Symptoms may include pain in the gum or jaw, inflammation in the gum around the tooth cause by trapped debris (pericoronitis) and prolonged headache or jaw ache. Pressure from impacted teeth may also cause **misalignment** in nearby teeth. Extraction is usually recommended for symptomatic impactions.



Horizontal

Mesioangular



Occlusion

The alignment of the upper and lower jaws and surfaces of the teeth is called occlusion (or bite). In many people, occlusion abnormalities (malocclusion) occur as a result of disproportionate teeth and jaw size, extra teeth, tooth loss, trauma, and other factors. Surgery and/or orthodontic treatment may be necessary to reposition and align the teeth.

Types of malocclusion Type 1: Overcrowding or poor positioning of the teeth. Type 2: Overbite (upper jaw overlapping the lower). Type 3: Underbite (protruding lower jaw and teeth).



Understanding Skin

Inside the skin

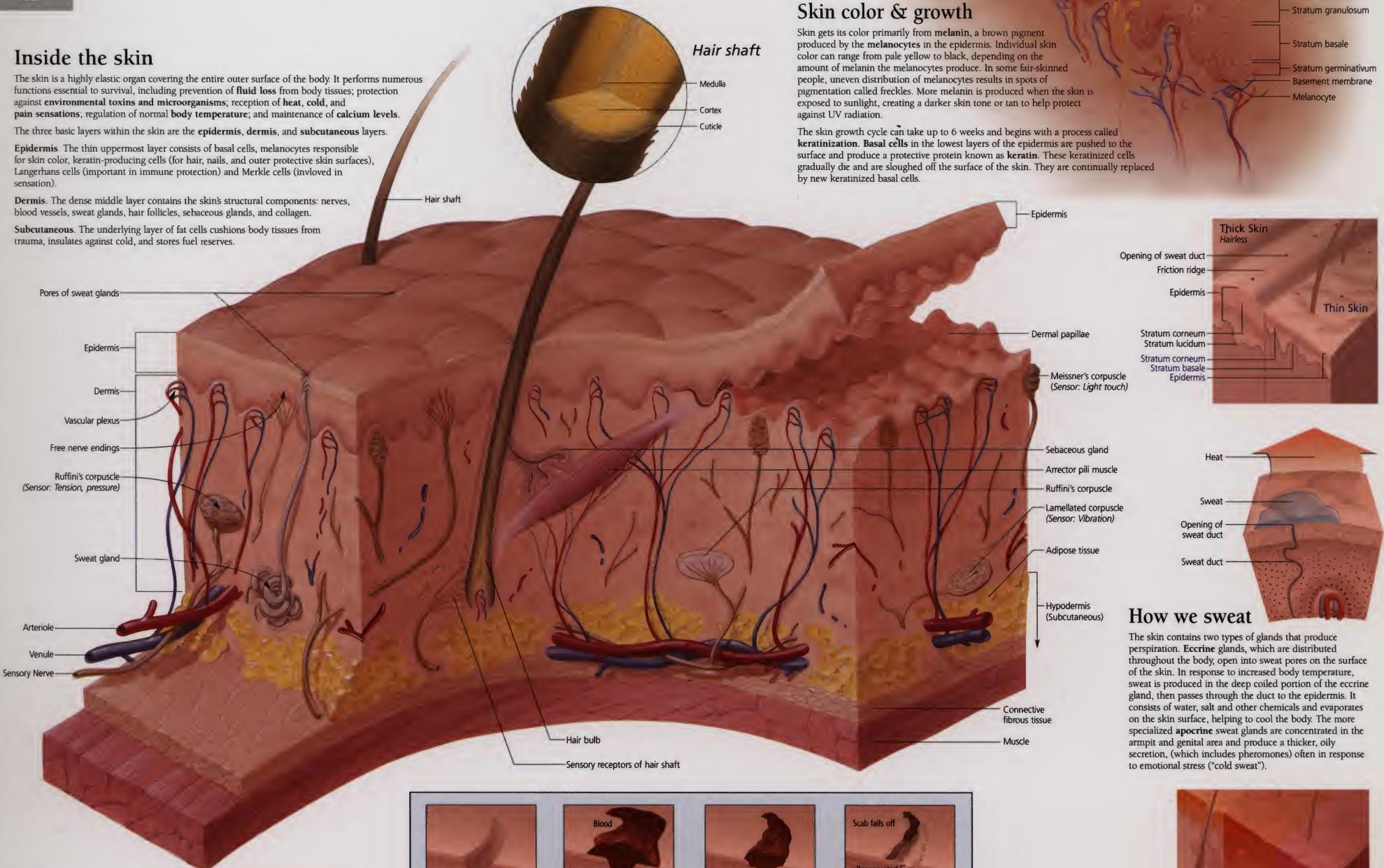
The skin is a highly elastic organ covering the entire outer surface of the body. It performs numerous functions essential to survival, including prevention of **fluid loss** from body tissues; protection against **environmental toxins and microorganisms**; reception of **heat, cold, and pain sensations**; regulation of **normal body temperature**; and maintenance of **calcium levels**.

The three basic layers within the skin are the **epidermis**, **dermis**, and **subcutaneous** layers.

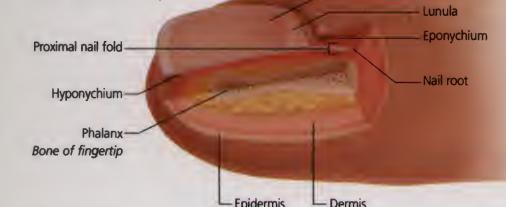
Epidermis: The thin uppermost layer consists of basal cells, melanocytes responsible for skin color, keratin-producing cells (for hair, nails, and outer protective skin surfaces), Langerhans cells (important in immune protection) and Merkel cells (involved in sensation).

Dermis: The dense middle layer contains the skin's structural components: nerves, blood vessels, sweat glands, hair follicles, sebaceous glands, and collagen.

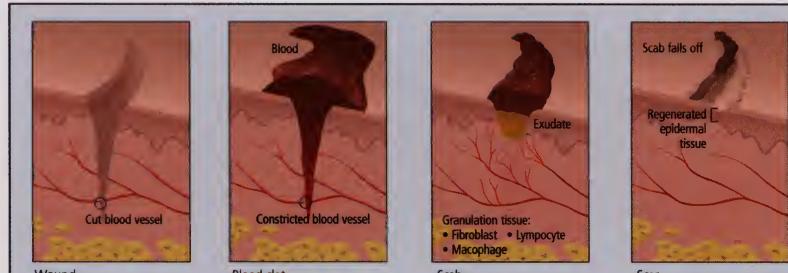
Subcutaneous: The underlying layer of fat cushions body tissues from trauma, insulates against cold, and stores fuel reserves.



Nail anatomy

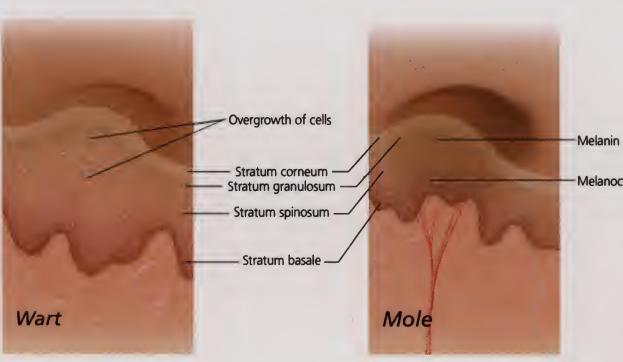
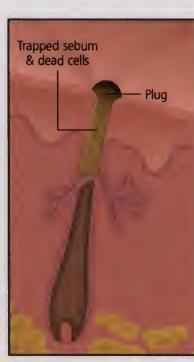
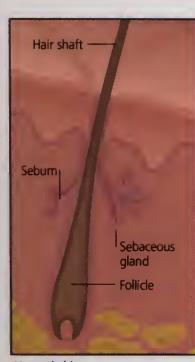


Like the hair, nails are an accessory structure of the skin. They contain plates of densely packed, keratinized epidermal cells which arise from superficial cells in the **nail matrix**, located under the skin behind the nail root. Above the nail root is the visible portion of the nail, called the **nail body**. The **free edge** of the nail extends from the nail body beyond the end of the finger or toe. Near the nail root is the **cuticle** or **lunula**, shaped like a half moon.



How wounds heal

After a wound occurs, the damaged portion of the skin begins to heal through a series of complex overlapping stages. In the first stage, a blood clot forms to stop bleeding and in most cases, dries to form a protective scab. Below the surface, inflammation takes place as nearby blood vessels enlarge and deliver oxygen and nutrient rich blood and leukocytes to cleanse the site of dead tissue and bacteria. Rapid proliferation (regeneration) and migration of new epithelial cells helps to replace the damaged area with new granulation tissue and close the wound. A less obvious scar is created when the edges of a wound are kept closed together during the healing process, allowing less granulated tissue to develop.



Skin and acne

Acne vulgaris is a common condition caused by inflammation in the **sebaceous glands** and **hair follicles**. Blemishes including **comedones** (blackheads and whiteheads), **pustules** (pimples), and **nodules** or **cysts** can appear on the face, neck or upper body. Usually beginning in adolescence, acne can last from 5 to 10 years. In some cases, acne may continue into adulthood or occur for the first time in adults.

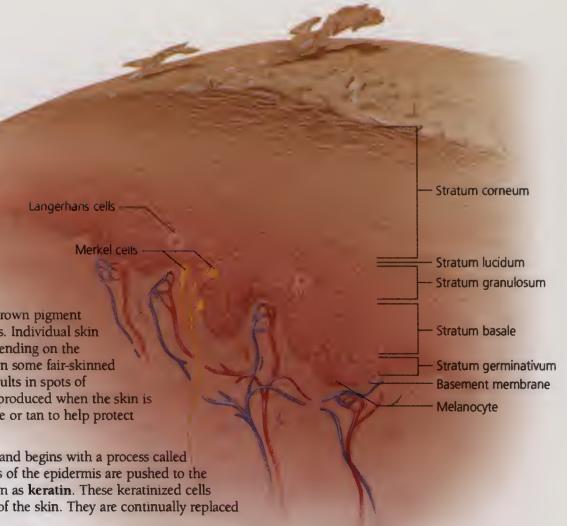
How acne develops:

- Hormones trigger an increase in the production of **sebum** (an oily substance important to skin lubrication) in the sebaceous glands.
- Excess sebum and dead skin cells become trapped in tiny **hair follicles** located near or within the sebaceous glands.
- Bacteria** from the skin enters the clogged follicles and multiply, causing inflammation, pus, and swelling (visible as comedones or pimples).
- In some cases, pustules may progress to nodules or cysts that extend deeper into the skin and cause scarring.

Warts & moles

Warts are hard, benign lumps on the surface of the skin, usually with a rough, raised surface and round or oval growth. Warts are produced when a virus enters the topmost layer of skin, causing an overgrowth of skin cells. Most common in children, they can be spread through **direct skin contact** and typically appear on the face, hands, or feet (often as **plantar warts**). Warts usually cause no discomfort and disappear within two years. However, treatments including medications, cryotherapy or electrocautery may be used to remove warts more quickly.

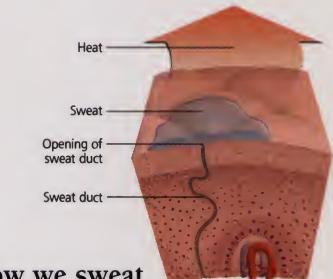
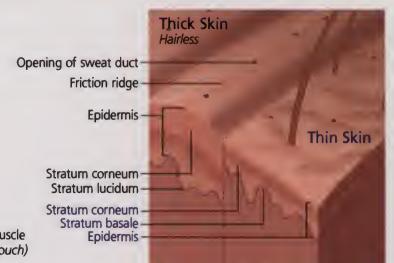
Moles are skin lesions common in light-skinned people that are often small and round and usually benign. Moles contain **melanin**, which gives them a brown or tan color. Also called **nevi** (singular: **nevus**), moles can range in size from tiny to very large and may have smooth or irregular borders. Unusual changes in the size or appearance of a nevus can be an important warning sign of **melanoma** (skin cancer).



Skin color & growth

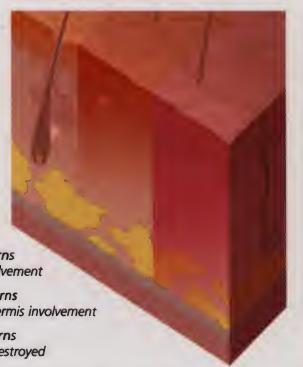
Skin gets its color primarily from **melanin**, a brown pigment produced by the **melanocytes** in the epidermis. Individual skin color can range from pale yellow to black, depending on the amount of melanin the melanocytes produce. In some fair-skinned people, uneven distribution of melanocytes results in spots of pigmentation called **freckles**. More melanin is produced when the skin is exposed to sunlight, creating a darker skin tone or **tan** to help protect against UV radiation.

The skin growth cycle can take up to 6 weeks and begins with a process called **keratinization**. **Basal cells** in the lowest layers of the epidermis are pushed to the surface and produce a protective protein known as **keratin**. These keratinized cells gradually die and are sloughed off the surface of the skin. They are continually replaced by new keratinized basal cells.



How we sweat

The skin contains two types of glands that produce perspiration. **Eccrine glands**, which are distributed throughout the body, open into sweat pores on the surface of the skin. In response to increased body temperature, sweat is produced in the deep coiled portion of the eccrine gland, then passes through the duct to the epidermis. It consists of water, salt and other chemicals and evaporates on the skin surface, helping to cool the body. The more specialized **apocrine sweat glands** are concentrated in the armpit and genital area and produce a thicker, oily secretion, (which includes pheromones) often in response to emotional stress ("cold sweat").



Burns

Burns are injuries to the skin that damage or destroy the skin's protective covering and functions. They can be caused by heat (contact with hot objects, scalding, or flames), ultraviolet light (sun or artificial tanning), chemicals, electricity, or even frostbite.

• **First degree burns** are limited to the epidermis. Symptoms include heat, pain, and reddening with minimal blistering or scarring.

• **Second degree burns** may be superficial or deep but usually extend below the epidermis into the dermis, affecting the sweat glands and hair follicles. Characterized by swelling, severe pain and blistering, and red, moist skin.

• **Third degree burns** extend from the dermis to the subcutaneous layer or underlying muscle. Charred, leathery skin may range in color from red to white or brown, with no blisters.

Skin cancer

Skin cancer is a malignant growth on the skin caused by the uncontrolled growth of epidermal cells. Skin cancer is associated with known **risk factors** including **sun exposure** and **sunburn**, **family history of skin cancer**, **light or pale complexion**, and **age**. Lesions may be small, shiny, waxy, crusty, or rough, asymmetrical in texture, or have an irregular border. Cancers are often larger than 6mm in size and can range in color from white to brown, or black. All unusual or suspicious skin lesions should be examined by a physician.

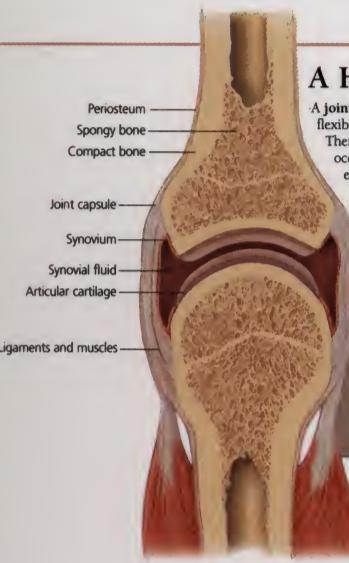




Osteoarthritis

What Is Arthritis?

Arthritis is a general term used to describe any process that causes joint damage. There are more than 100 different types of arthritis. Most involve swelling, tenderness and pain in various joints of the body. **Osteoarthritis** is the most common type of arthritis. Other types include **rheumatoid arthritis** and **gout**.

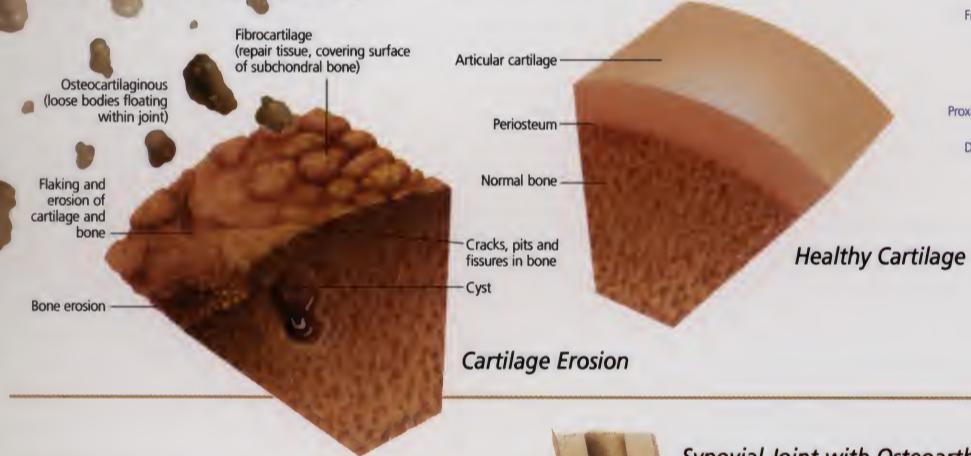


A Healthy Joint

A joint is any location in the body where two bones come together. Ligaments and other flexible structures surrounding a joint hold the bones together and allow for movement. There are several types of joints that permit different degrees of movement. OA usually occurs in **synovial joints**, which are the most freely movable. Specialized structures inside each of these joints provide a protected, shock-absorbing, self-lubricated environment capable of delivering a wide range of precise movements with minimal friction.

Articular Cartilage

Inside a joint, articular cartilage covers and protects the surface of each bone. The unique structure of cartilage allows it to bear the brunt of the stress placed on the joint during movement. Different from most tissues, cartilage has no blood vessels or nerves so inflammation and pain cannot occur. Each surface is smooth and precisely shaped to minimize friction. Large amounts of flexible matrix allow surfaces to constantly adapt as they glide over each other. Collagen fibers more densely packed at the surface distribute stress and prevent harmful substances from entering the cartilage.



Effects of OA

OA is a slow, progressive process that begins at the cellular level within the articular cartilage, probably as early as in the third decade of life. For reasons not currently understood, the collagen meshwork begins to break up, altering the joints' resilience to stress and causing microfractures. Any unsuccessful repair attempt leaves the cartilage stiffer, leading to more microfractures. The cartilage surface, once firm and smooth, becomes soft, rough and irregular. As the protective surface wears away, harmful enzymes enter the cartilage and further damage the matrix. Erosion of cartilage continues until bone is exposed.

Once cartilage is damaged, stress from movement is transferred to other structures within the joint. Unlike healthy cartilage, many of these structures hold up very poorly under stress, becoming injured, inflamed and increasingly painful.



Treatment of Osteoarthritis

Currently there is no cure for OA, but a great deal can be done to manage and even postpone its effects. Treatment focuses on performing daily activities, managing pain and preventing disability.

Exercise

Daily exercise, the most important element of OA treatment, is essential to maintaining range of motion in a joint, avoiding stiffness, strengthening the structures that surround and protect the joint and delivering nutrients to the cartilage. It is very important to balance exercise with adequate periods of rest.

Medication

Nonmedicinal types of pain relief, such as heat and massage, can be very effective. If medication is needed for pain relief, however, it is important to take the smallest effective dose of the safest effective medication. Acetaminophen is usually tried first because it has very few side effects. NSAIDS (nonsteroidal anti-inflammatory drugs), such as aspirin and ibuprofen, can be tried if acetaminophen is ineffective. In extreme cases, cortisone can be injected directly into a joint to relieve pain. However, cortisone and most NSAIDS can cause more serious side effects.

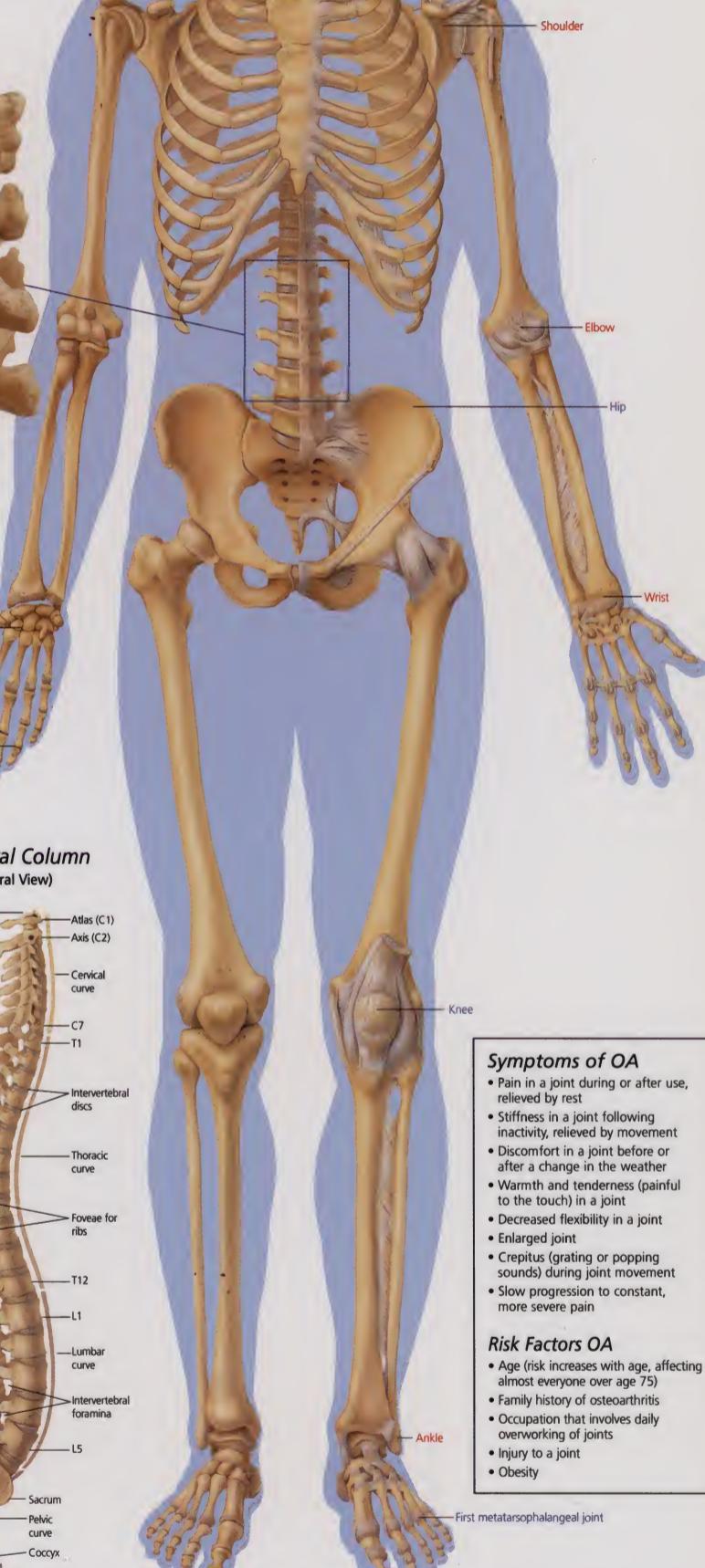
Surgery

When all other methods of pain relief have failed, surgery might become an option. Surgery can range from modifying a joint to completely replacing a joint with a prosthetic one.

Joints Affected by Osteoarthritis

■ Most Common
■ Less Common

Temporomandibular joint (TMJ)



Take Control of Your Arthritis

- Educate yourself about osteoarthritis
- Modify your living space to decrease strain on affected joints; for example, move frequently used items off high shelves
- Keep a daily record of activities, rest, medication and any pain experienced to help determine what works best for you
- Work with your healthcare provider to determine an appropriate balance of exercise and rest
- Exercise every day according to your healthcare provider's instructions
- Discuss potential side effects of medication with your healthcare provider
- If necessary, use splints or braces to support affected joints
- Shed extra weight to decrease strain on your joints

Remember, inactivity can make osteoarthritis worse



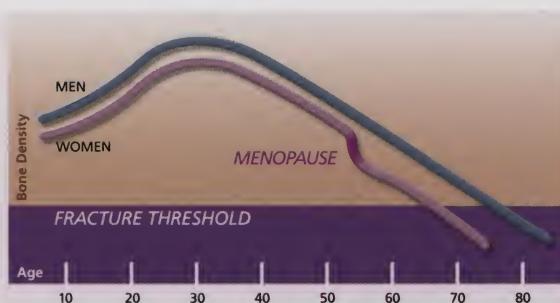
Understanding Osteoporosis

What Is Osteoporosis?

Osteoporosis is loss of bone mass due to an imbalance in the bone remodeling cycle. The lack of bone density causes instability and a greater likelihood of broken bones. Bones undergo a change on a daily basis. Existing bone tissue is broken down and replaced by new tissue to provide bone mass. Under normal circumstances, the two distinct processes work together to provide a consistent bone mass. As people age, bone remodeling slows, but the tearing down of bone tissue continues at the same pace. The imbalance eventually creates a net loss in bone mass. This natural occurrence is worsened by not providing basic bone-building nutrients to the body such as calcium, proteins and vitamin D.

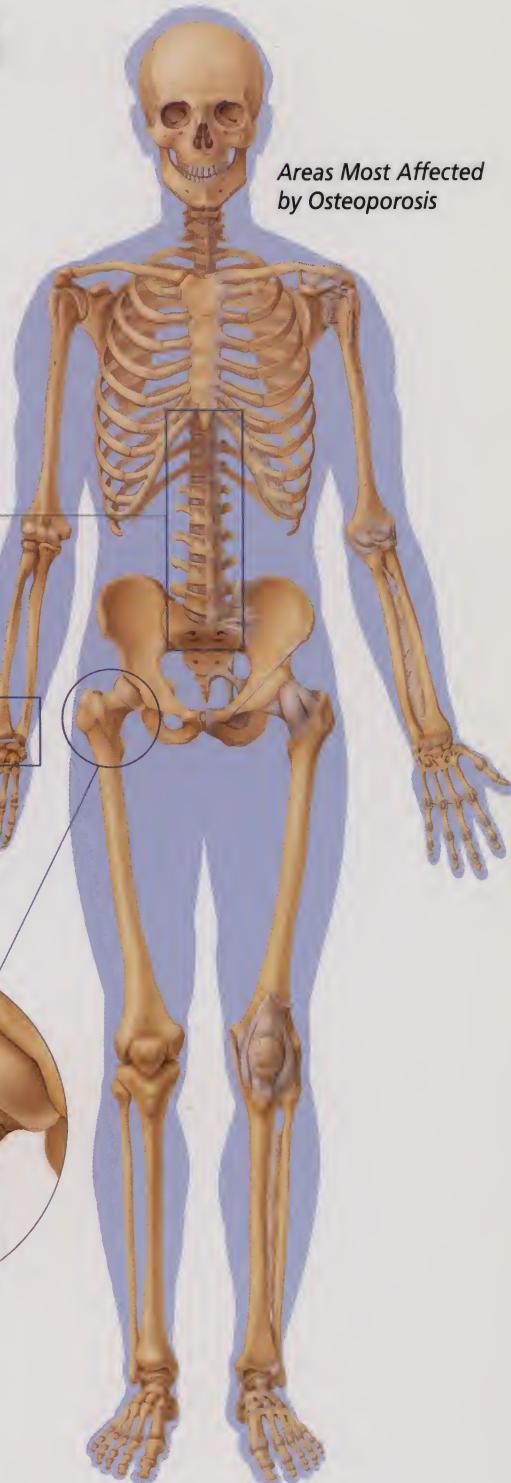
Bone Density Changes

Bone tissue density changes continually, because of the cycle of replenishing old with new tissue. From birth through adolescence, the cycle places heavier emphasis on building new tissue resulting in a net increase in bone mass. As people reach their 20s and 30s, bone tissue is maintained at a healthy level because of the normal tissue formation cycle and a healthy diet and lifestyle. As women reach menopause, lack of estrogen production hinders the building of bone tissue. Men are affected to a lesser extent, but do experience net bone tissue loss.



What Causes Osteoporosis?

Osteoporosis is a common side effect of aging. Its severity is a function of risk factors, such as gender, genetics, diet and lifestyle. The highest risk group is post-menopausal women, who have lower levels of estrogen. (Estrogen carries calcium to bone tissue.) Younger women who experience amenorrhea (lack of menstrual periods) are at greater risk as well. Women that exercise excessively or have an eating disorder such as anorexia nervosa can develop osteoporosis earlier in life. At any age, whether male or female, a calcium deficient diet would tend to increase the risk of osteoporosis.



Areas Most Affected by Osteoporosis

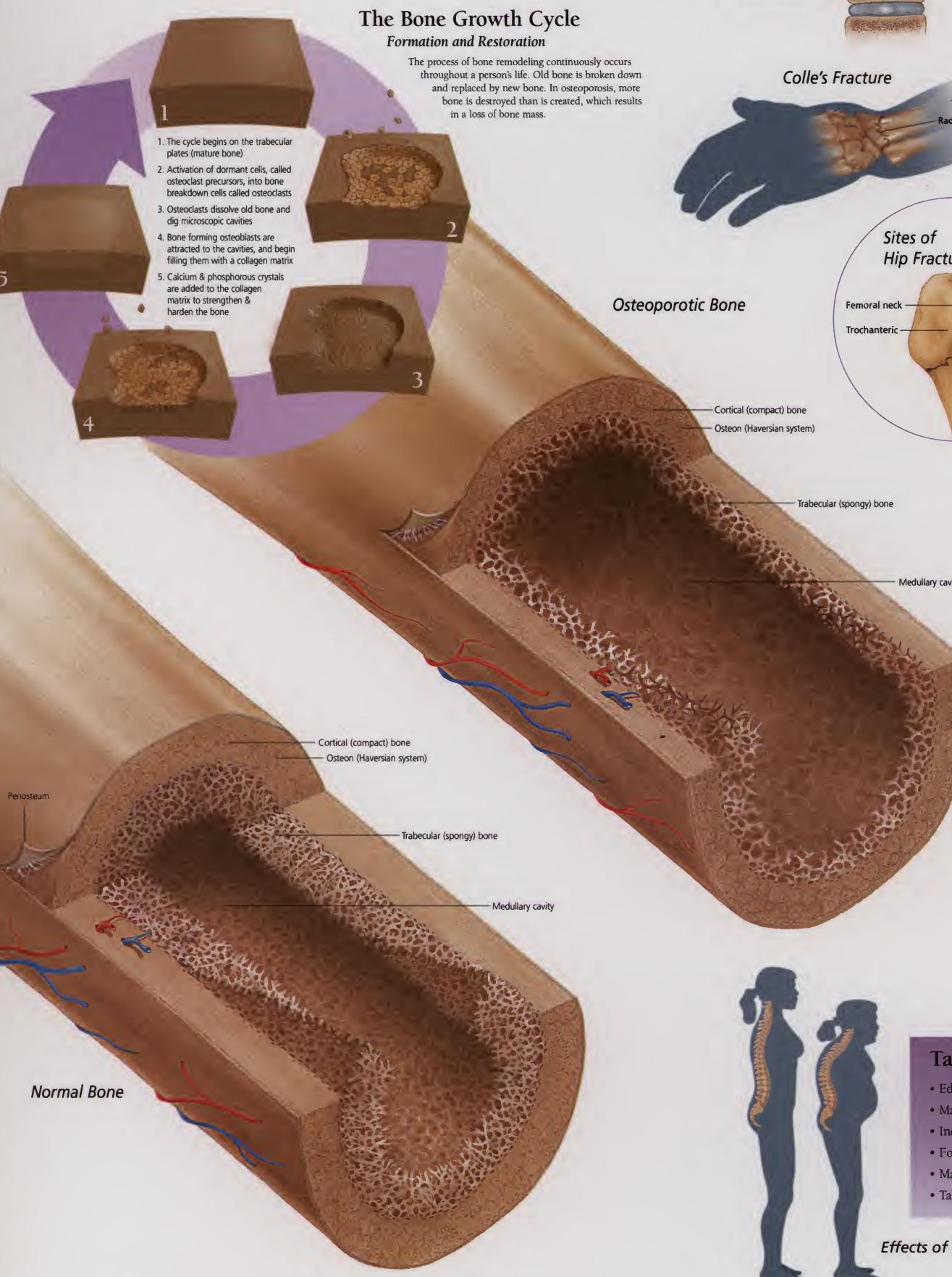
The Bone Growth Cycle

Formation and Restoration

The process of bone remodeling continually occurs throughout a person's life. Old bone is broken down and replaced by new bone. In osteoporosis, more bone is destroyed than is created, which results in a loss of bone mass.

1. The cycle begins on the trabecular plates (mature bone)
2. Activation of dormant cells, called osteoclast precursors, into bone breakdown cells called osteoclasts
3. Osteoclasts dissolve old bone and dig microscopic cavities
4. Bone forming osteoblasts are attracted to the cavities, and begin filling them with a collagen matrix
5. Calcium & phosphorous crystals are added to the collagen matrix to strengthen & harden the bone

Osteoporotic Bone



Symptoms of Osteoporosis

There are no early, unique or distinctive signs of osteoporosis, but if any of the following occur, a physician might diagnose the onset of osteoporosis:

- Back pain
- Development of a hunched back and abdominal protrusion
- Bone fractures resulting from an apparent minor trauma
- Reduction in height

Risk Factors

- Post-menopause estrogen deficiency
- Ethnicity (Caucasian or Asian groups are at the highest risk)
- Family history of osteoporosis
- Eating disorders such as anorexia or bulimia
- Vigorous exercise program
- Overweight
- Alcoholism
- Thyroid disease
- Prolonged use of the anticoagulant heparin
- Males with reduced testosterone

Taking Control of Your Osteoporosis

- Educate yourself about osteoporosis — it's easier to prevent than treat
- Maintain a calcium-rich diet — 1,000mg to 1,200mg per day
- Include vitamin D supplements in your diet
- Follow a reasonable exercise program
- Maintain a balanced posture to limit stress on the spine
- Take Hormone Replacement Therapy, if directed by a physician

Effects of Osteoporosis (Progressive Spinal Deformity)





Rheumatoid Arthritis

What Is Arthritis?

The term arthritis refers to a number of disease processes that cause damage to the joints and commonly involve swelling, tenderness, stiffness and pain. There are more than 100 different types of arthritis, including osteoarthritis and rheumatoid arthritis.

What Is Rheumatoid Arthritis?

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory disease primarily affecting the synovial joints. For unknown reasons, the immune system attacks the linings (synovial membranes) of joints such as the hands, wrists, feet, and knees. The joints often become chronically inflamed, leading to swelling, pain, stiffness, and changes in joint mobility and function. Fluid and inflammatory cells accumulate in the synovium to produce pannus, an invasive tissue that covers the surface of the joint's articular cartilage and erodes the cartilage, bone, ligaments, and tendons.

Continuing inflammation of the synovium can eventually cause irreversible damage to the bones of the joint.

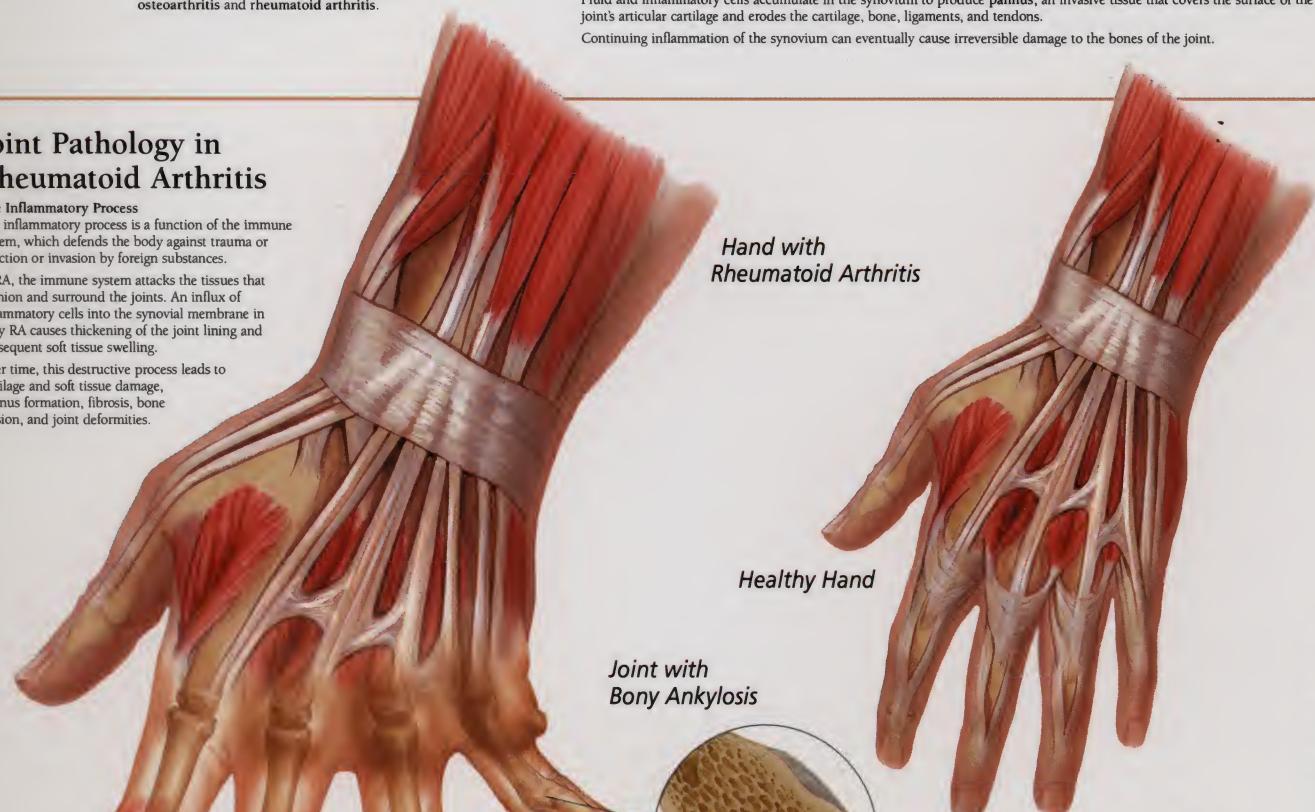
Joint Pathology in Rheumatoid Arthritis

The Inflammatory Process

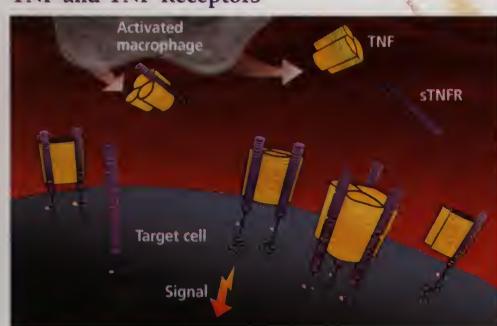
The inflammatory process is a function of the immune system, which defends the body against trauma or infection or invasion by foreign substances.

In RA, the immune system attacks the tissues that cushion and surround the joints. An influx of inflammatory cells into the synovial membrane in early RA causes thickening of the joint lining and subsequent soft tissue swelling.

Over time, this destructive process leads to cartilage and soft tissue damage, pannus formation, fibrosis, bone erosion, and joint deformities.



TNF and TNF Receptors



Understanding Inflammation

As part of the chronic inflammatory response seen in RA, a destructive layer of cells called pannus forms and covers the articular surfaces of the joints, gradually eroding cartilage and bone.

The inflammatory properties of the rheumatoid synovial fluid in joints with RA also contribute to overall inflammation and damage to the surrounding tissues.

One important inflammatory cytokine found in synovial fluid is called tumor necrosis factor (TNF), which has been associated with the production of enzymes that attack the cartilage. TNF also stimulates pannus cells to produce other destructive substances.

Diagnosis and Treatment of Rheumatoid Arthritis

An important prognostic factor in assessing RA is the presence or absence of rheumatoid factor (RF), an antibody found in the blood of many RA patients. A lower or negative RF level may indicate a milder form of RA disease.

While there is presently no cure for RA, treatments are available to manage and even postpone its effects. DMARD (disease-modifying antirheumatic drug) therapy is prescribed to relieve pain and inflammation. Early treatment with DMARDs may also increase the window of opportunity for potential remission and help prevent structural joint damage.

Exercise

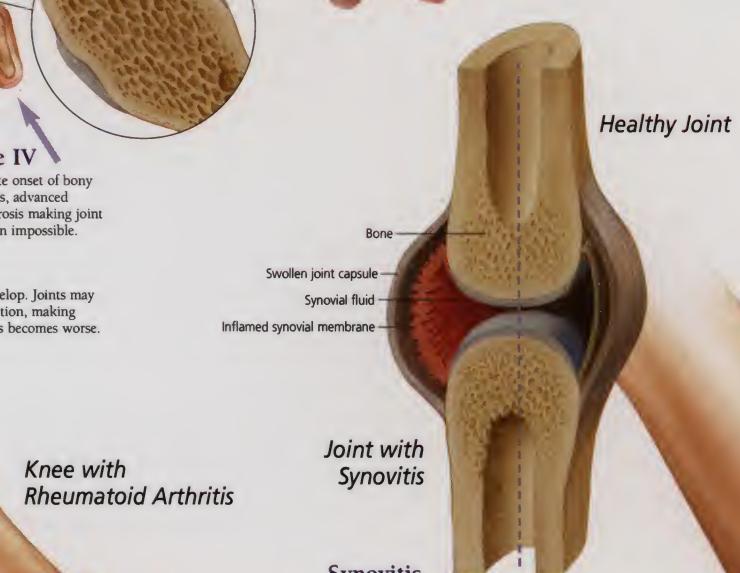
Daily exercise often helps to maintain range of motion in joints, avoid stiffness, and strengthen the structures that surround and protect joints. It is important to balance exercise with adequate periods of rest.

Medication

The object of most drug therapies is to relieve pain, reduce inflammation, help inhibit the progression of joint damage and deformity, preserve movement, and control systemic involvement of the disease. Nonmedicinal types of pain relief, such as heat and massage, can be helpful.

Surgery

When all other methods of pain relief have failed, surgery may become an option. Surgery can range from tendon repair to complete joint replacement.

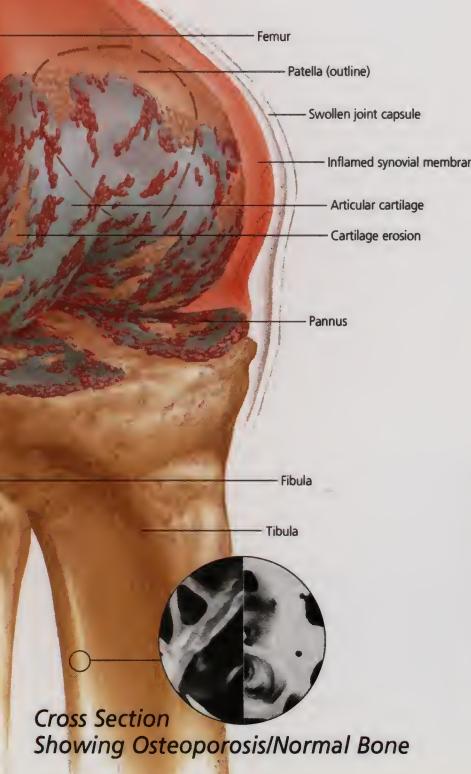


Knee with Rheumatoid Arthritis

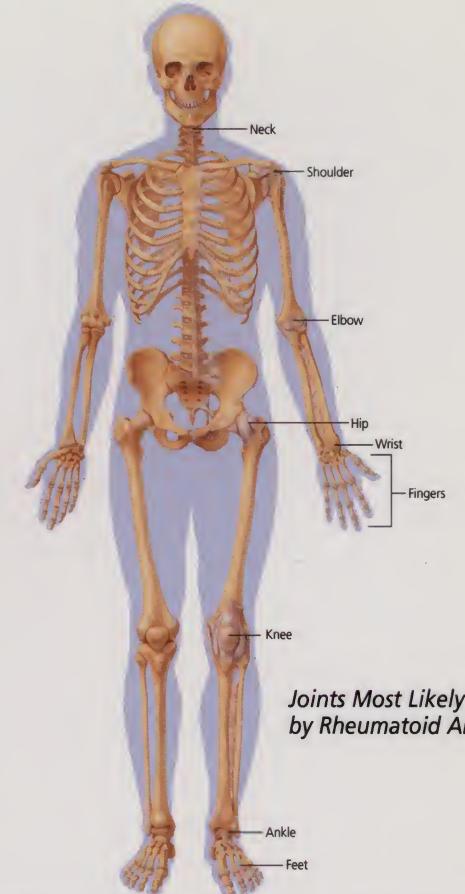
Joint with Synovitis

Synovitis

In a joint affected by RA, the synovial membrane is inflamed and swollen invading bone and cartilage. The joint capsule is swollen and the cartilage is thin, resulting in a narrowed joint space.



Cross Section Showing Osteoporosis/Normal Bone



What Causes Rheumatoid Arthritis?

The cause of rheumatoid arthritis remains unknown, but is thought to be linked to a combination of genetic and environmental factors triggering an abnormal or defective immune response.

Factors under investigation for their potential role in the development of RA include autoantibodies such as rheumatoid factor (RF), proinflammatory substances known as cytokines (including tumor necrosis factor-alpha or TNF- α), and possible infectious microorganisms.

Research into the causes and development of RA continues to evolve and provides new direction for treatment strategies.

Signs & Symptoms of RA

Signs and symptoms listed below may appear suddenly or develop over time.

- Fatigue and weakness
- Joint pain, warmth, swelling, or tenderness
- Joints affected in symmetrical pattern; eg, both wrists, shoulders
- Joint stiffness, usually lasting longer than an hour after awakening or inactivity
- A feeling of generalized stiffness
- Low grade fever
- Anorexia and weight loss
- Limited joint mobility
- Subcutaneous nodules
- Evidence of joint or bone erosion

Some Risk Factors for RA

- Women are two to three times more likely to develop RA than men
- Family history of rheumatoid arthritis

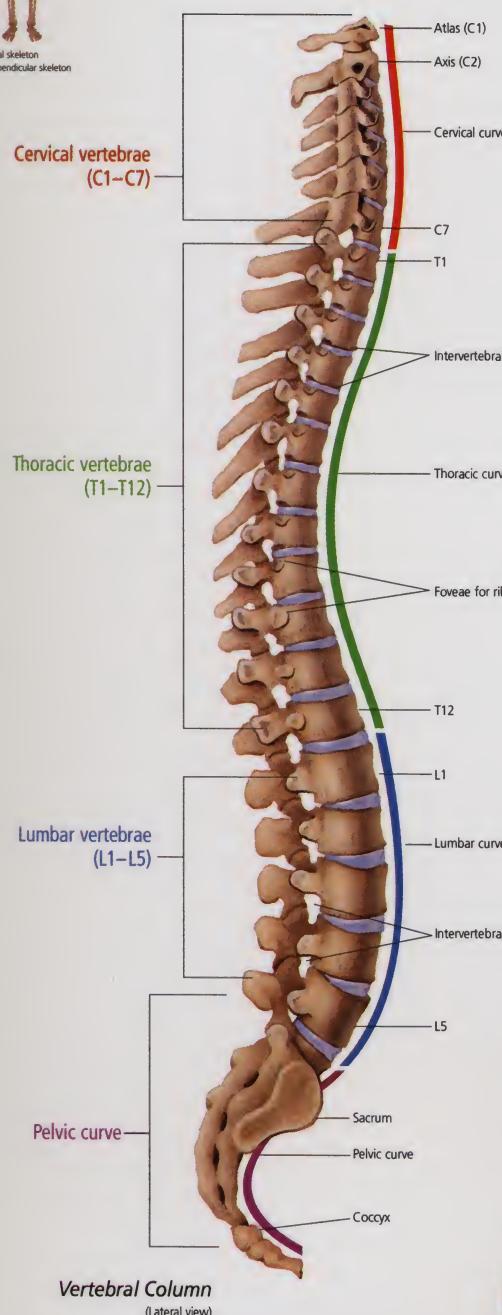
Taking Control of Your Rheumatoid Arthritis

- Educate yourself about rheumatoid arthritis
- Work with your health care provider to determine an appropriate balance of exercise and rest
- Discuss appropriate medical treatments with your health care provider
- Follow a nutritious and healthy diet, including plant and fish oils to help reduce inflammation
- Shed extra weight to decrease strain on the joints

Remember, early detection and aggressive therapy are important in successful management of your Rheumatoid Arthritis.

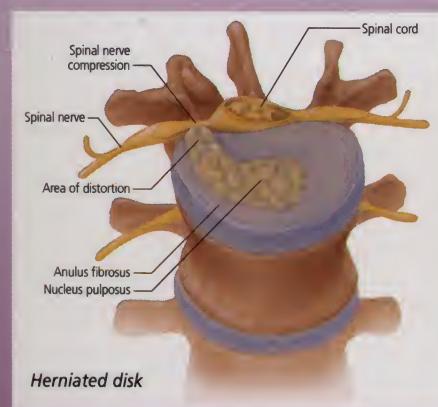


Understanding the Spine



Lower back pain

The lower back or lumbar region supports the weight of the upper body and connects the chest to the pelvis and legs. Most back pain occurs in this part of the spine because it is involved in frequent movement such as bending, twisting, turning, standing, walking, and lifting. Back pain is often classified as either acute (lasting from a few days to 3 months) or chronic (lasting 3 months or longer) and may range in severity from a dull ache to shooting or stabbing pain that limits motion, flexibility, and/or the ability to stand upright. Because discs weaken with age, low back pain is usually age-related, occurring most frequently in adults through the mid-sixties.

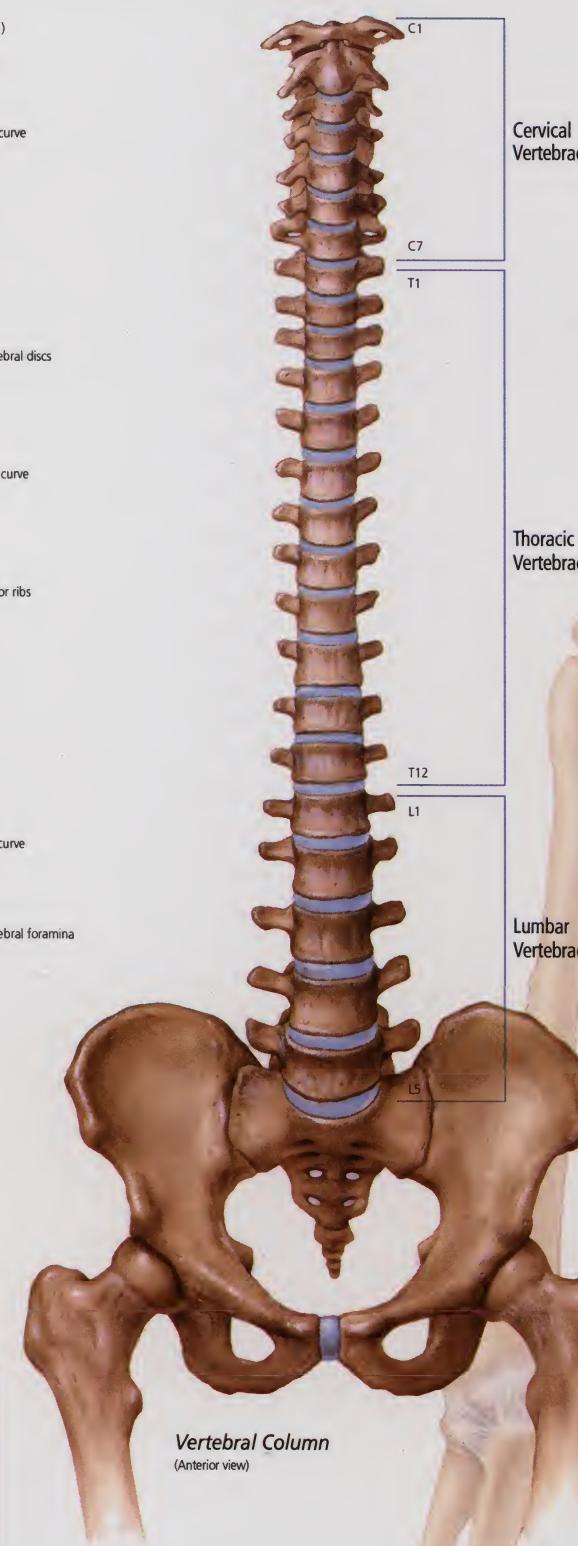


Causes of lower back pain

Most acute lower back pain occurs as the result of stress on the muscles and ligaments that support the spine. A sedentary lifestyle and obesity also increase the risks of back injury and pain. Chronic back pain may be caused by underlying illness such as arthritis or depression. Treatment of back pain varies depending on cause and severity but may include heat or ice application, limited exercise, over-the-counter or prescription medications, or in extreme cases, surgery.

Typical causes of acute back pain include:

- Ruptured (herniated) disc
- Muscle strains or sprains
- Degenerative disc disease
- Spinal stenosis
- Sciatica
- Sacroiliitis



What Is Osteoarthritis?

Osteoarthritis (OA), also called degenerative joint disease or osteoarthritis, has existed for centuries, occurring in many animals as well as humans. Currently, over 20 million people in the U.S. have OA. It is characterized by a gradual loss of cartilage and overgrowth of bone, often within only one or a few joints. Unlike other forms of arthritis, OA does not spread to other parts of the body. OA can occur in almost any movable joint but most commonly affects the spine, hips, knees, hands or feet.

Risk Factors for OA

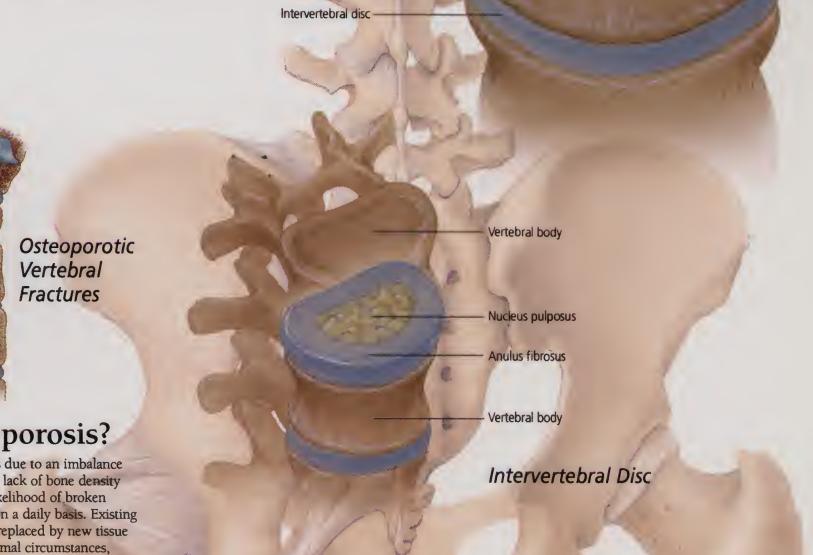
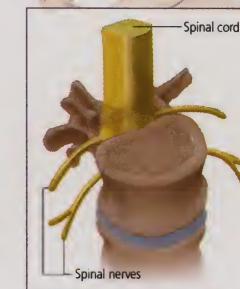
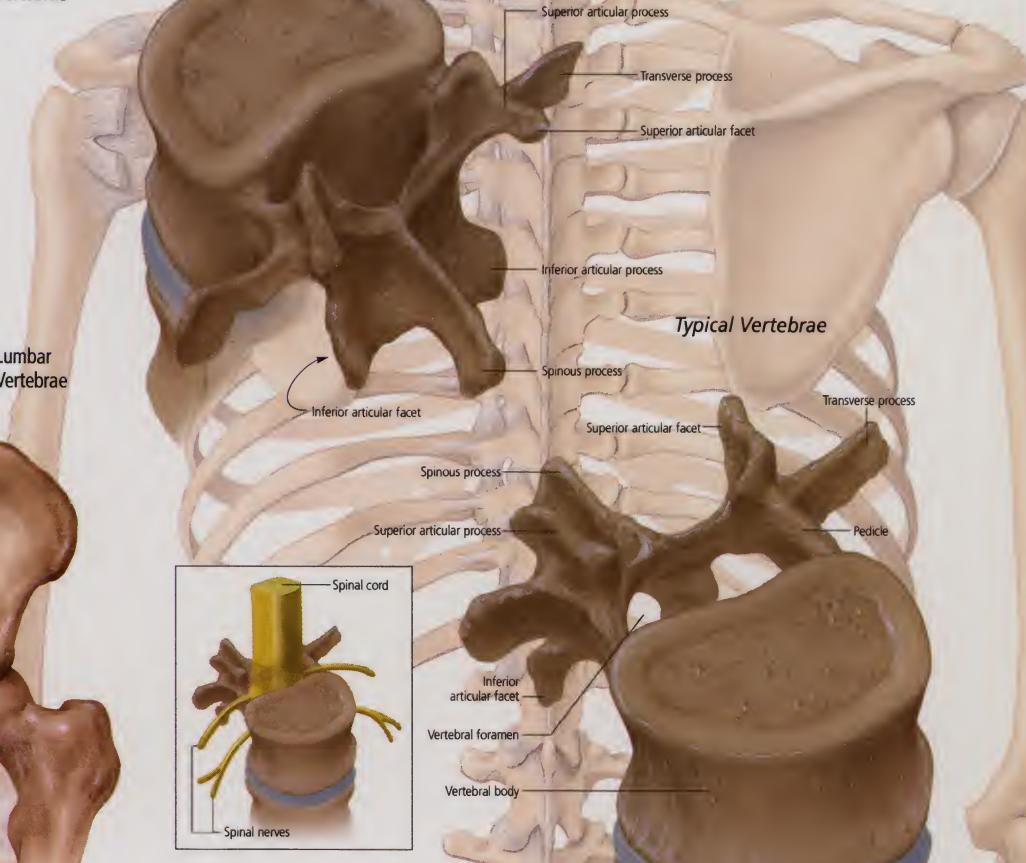
- Age (risk increases with age, affecting almost everyone over age 75 years)
- Family history of osteoarthritis
- Occupation that involves daily overworking of joints
- Injury to a joint
- Obesity

The spine

The spine is a column of 26 bones extending from the base of the skull to the pelvis. It is made up of 24 vertebrae: 7 cervical (neck), 12 thoracic (upper back), and 5 lumbar (lower back). The sacrum lies at the base of the lumbar region and is fused to the coccyx (tail bone). The spine provides support for the head, shoulders and chest and protects the spinal cord, a long, fragile structure composed of nerves that transmit signals between the brain and body, enabling movement and sensation. As the spinal cord passes through the vertebral foramen at the center of the vertebrae, pairs of spinal nerves (roots) enter and emerge between the vertebral spaces, connecting with nerves throughout the body. The spinal column is cushioned and protected by intervertebral discs made of a spongy outer ring of cartilage and a jelly-like fluid center. The spine is held in place by ligaments and tendons that attach to bony processes at the back (posterior) of the vertebrae and connect to the muscles of the back.



Typical Vertebrae



What Is Osteoporosis?

Osteoporosis is loss of bone mass due to an imbalance in the bone remodeling cycle. The lack of bone density causes instability and a greater likelihood of broken bones. Bones undergo a change on a daily basis. Existing bone tissue is broken down and replaced by new tissue to provide bone mass. Under normal circumstances, the two distinct processes work together to provide a consistent bone mass. As people age, bone remodeling slows, but the tearing down of bone tissue continues at the same pace. The imbalance eventually creates a net loss in bone mass. This natural occurrence is worsened by not providing basic bone-building nutrients to the body such as calcium, proteins and vitamin D.

Risk Factors for OP

- Post-menopausal women
- Ethnicity, Caucasian or Asian are at the highest risk
- Family history of osteoporosis
- Eating disorders such as anorexia or bulimia
- Vigorous exercise program
- Overweight
- Alcoholism
- Thyroid disease
- Prolonged use of the anticoagulant, heparin
- Males with reduced testosterone

Spinal deformities

In the normal spine, the inward curve of the lumbar spine is called lordotic and the outward curve of the thoracic spine is called kyphotic. Abnormal exaggeration of these curves or sideways curvature of the spine (scoliosis) may develop in children or adults with varying degrees of severity.

Lordosis or swayback is an excessive curvature of the lumbar spine. It may be congenital (present at birth) or caused by poor posture, neuromuscular disorders, hip problems, injury or infection. Exercise may stop the progression of the deformity.

Kyphosis is a thoracic spinal deformity that may be congenital or acquired as a result of other conditions, including Scheuermann's disease, which causes excessive curvature of the thoracic vertebrae. Symptoms may include unequal shoulder height, back pain, forward bending of the head and other complications. It may be treated with bracing or surgery.

Scoliosis commonly affects adolescents, particularly girls. Symptoms include side-to-side curvature of the upper or lower spine, unequal shoulder and hip height, sore or stiff back, and other complications. Many cases remain mild. More severe cases may be treated by a brace or surgical bonding of the vertebrae.



Understanding the Hip & Knee

Hip and Knee
(Anterior View)

Tibial Plateau

Posterior cruciate
ligament (PCL) tear

Anterior cruciate
ligament (ACL) tear

Knee with Osteoarthritis

Knee with Rheumatoid Arthritis

Sites of Hip Fractures

Fractures

Fractures to the hip joint are most common in the elderly but can also occur as a result of trauma, such as a high-impact car accident.

The three major types of hip fractures are **intracapsular** (inside the thick articular capsule of the joint), involving the neck of the femur; **extracapsular**, with injury to the intertrochanter of the femur or a fracture of the shaft; and **stress fractures**, which can occur in the neck or shaft of the femur, or the inferior pubic ramus of the hip.

Intracapsular fractures often involve vascular injury and are difficult to heal. Osteoporosis, age, gender, and lifestyle factors can increase the risks of hip fracture.

The hip

The **os coxa** (hip bone) consists of three separate bones fused together after childhood to form one side of the pelvic girdle. The upper portion of the os coxa is the fan-shaped **iliac bone**. The lower back third of the os coxa is the **ischial bone**. Above this is the **pubis bone**, which forms the lower front part of the hip. The hip is a multiaxial ball and socket joint formed where the head of the **femur** (thigh bone) articulates with a deep, cup-shaped socket in the os coxa called the **acetabulum**. The head of the femur is held in place by the strong ligaments of the **Joint capsule** and is covered by a layer of smooth cartilage to cushion the joint and minimize friction. Numerous muscles surround the hip, enabling a wide range of movement: flexion, extension, abduction, adduction, rotation and circumduction.

The knee

The knee connects the **femur** and the **tibia** and bears more weight than any other joint. It is a complex hinge-type joint formed by the articulations of the femur and tibia with the **patella**, the bone at the front of the knee. Because the femur is set an oblique angle to the knee, there is a space present between the tibia and femur, called the **articular cavity**. This cavity is stabilized by the anterior and posterior cruciate ligaments, which bind the tibia to the femur and are further supported by rings of fibrous cartilage called **menisci**. A joint capsule surrounds the knee and is reinforced on each side by powerful collateral ligaments. The knee also relies heavily on the strength of the **quadriceps** and **hamstring** muscles. The principal movements of the knee are flexion and extension, with rotation possible only when the knee is flexed.

Anterolateral view
of the knee in extension

A healthy joint

A **joint** is any location in the body where two bones come together. Ligaments and other flexible structures surrounding a joint hold the bones together to allow for movement. There are several types of joints that permit different degrees of movement. Joint disease usually occurs in **synovial joints**, which are the most freely movable. Specialized structures inside each of these joints form a protected, shock-absorbing, self-lubricated environment capable of delivering a wide range of precise movements with minimal friction.

Compression

Expansion

Exchange of nutrients

Unlike cartilage, the **synovial membrane** is loaded with blood vessels. Synovial fluid secreted by the synovial membrane is rich in nutrients from the blood. Since cartilage is like a dense sponge, repeated compression and expansion during and after joint movement circulates synovial fluid throughout the cartilage, removing waste and delivering necessary nutrients.

Meniscus and ligament tears

A meniscus tear is a common injury to the fibrous cartilage between the femur and tibia. Sudden trauma to the knee, such as violent twisting or side impact, can cause fragments of the menisci to be torn away. Fragments caught in the small spaces between the bones of the joint can cause pain, swelling, and "locking" of the knee joint. Gradual degeneration of the cartilage with age can also result in a sudden meniscus tear. Ligament injuries can range from micro tears (sprains) to complete tears of the ligaments and nerves. **Anterior cruciate ligament (ACL)** tears are often severe, resulting from sudden deceleration, rapid changes in direction, or jumping. The knee becomes very unstable, usually requiring surgery. **Posterior cruciate ligament (PCL)** injuries are caused by hyperextension or hyperflexion of the knee. **Medial collateral ligaments (MCL)** tears affect the outside of the knee, typically from clipping contact or twisting, and often heal without surgery. **Lateral collateral ligaments (LCL)** injuries are uncommon and rarely require surgery.

Fibular collateral
ligament tear

Tear of the lateral meniscus

Tear of the medial meniscus

Synovial Joint
(Longitudinal Section)

Ligaments and muscles

Joint capsule

Synovial membrane

Synovial fluid

Articular cartilage

Compact bone

Spongy bone

Periosteum

Knee with Osteoarthritis

Knee with Rheumatoid Arthritis

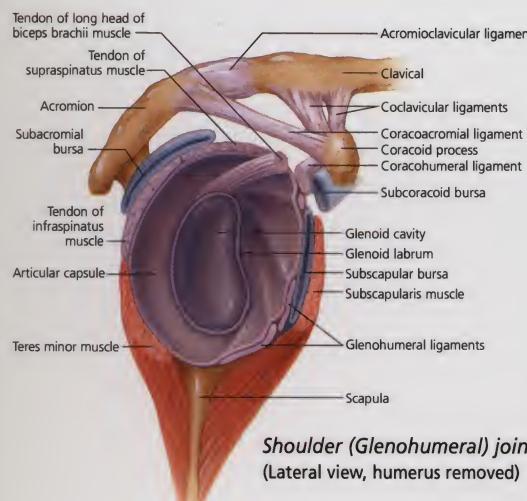
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PLATE 30



Understanding the Shoulder & Elbow

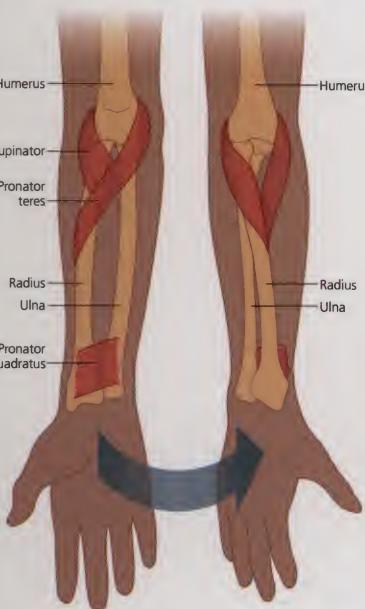


Shoulder (Glenohumeral joint)
(Lateral view, humerus removed)



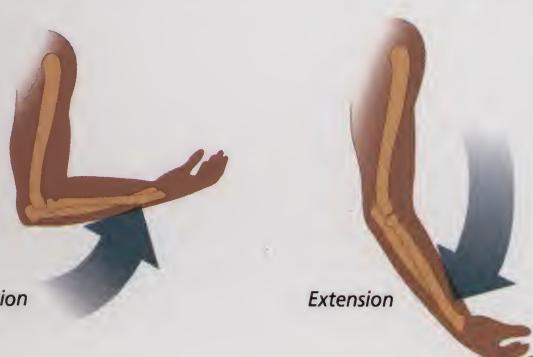
The elbow

The elbow joint is a uniaxial, hinge-shaped joint created by the articulation of the humerus with the radius and ulna (bones of the forearm). It is encased in a fibrous capsule and supported by strong radial and ulnar collateral ligaments. Three distinct articulations within the elbow are responsible for the movements of the forearm. The radioulnar and humeroradial joints allow supination and pronation (rotation of the palm). The humeroulnar joint permits flexion and extension. These joints work in concert with the triceps muscle to enable elbow extension, the biceps for flexion and supination, and the pronator muscles (in the front of the forearm) for pronation.



Supination

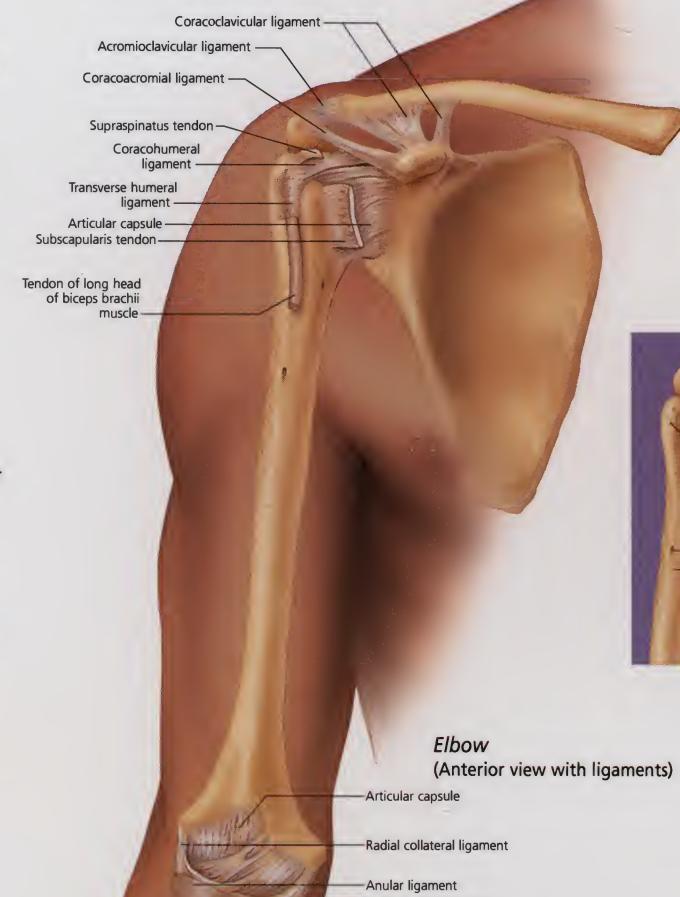
Pronation



Flexion

Extension

Shoulder
(Anterior view with ligaments)

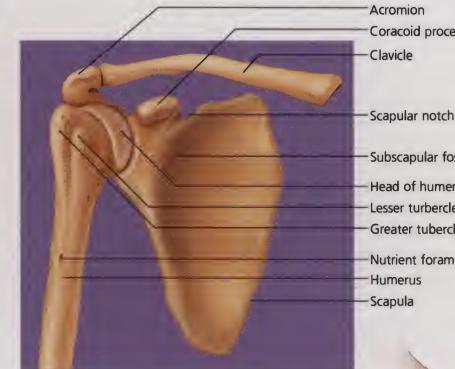


The shoulder

The shoulder is a multiaxial ball and socket joint capable of the widest range of motion of any joint in the body. It is made up of three major bones: the scapula (shoulder blade), clavicle (collarbone), and humerus (upper arm bone). The shoulder joint is formed where the head of the humerus articulates with the small shallow **glenoid cavity** of the scapula and is enclosed in a thin fibrous capsule. The shoulder's stability and range of motion depend heavily on its supporting structures, including the **acromioclavicular** and **sternoclavicular** joints, collateral ligaments, tendons, and muscles. Principal muscles supporting the shoulder include the **rotator cuff**, a group of short muscles forming the tendon that connects the scapula to the upper arm, and the large **deltoid** muscle, which allows the shoulder to flex and the arm to lift, straighten and push backwards.



Shoulder –
(Ball & socket joint)

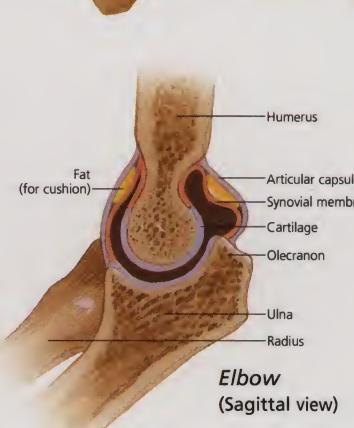
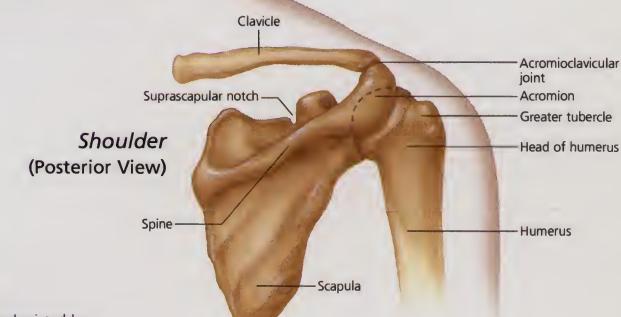


Shoulder
(Anterior view)

Elbow
(Anterior view with ligaments)

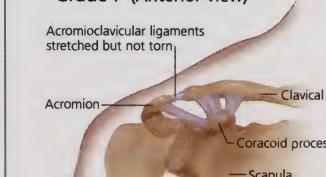


Elbow
(Anterior view)



Elbow
(Sagittal view)

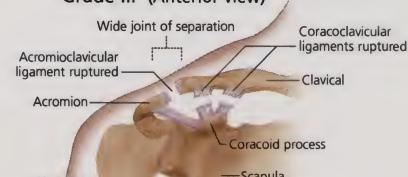
Acromioclavicular dislocation
Grade I (Anterior view)



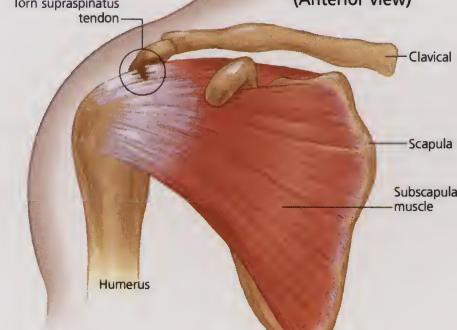
Acromioclavicular dislocation
Grade II (Anterior view)



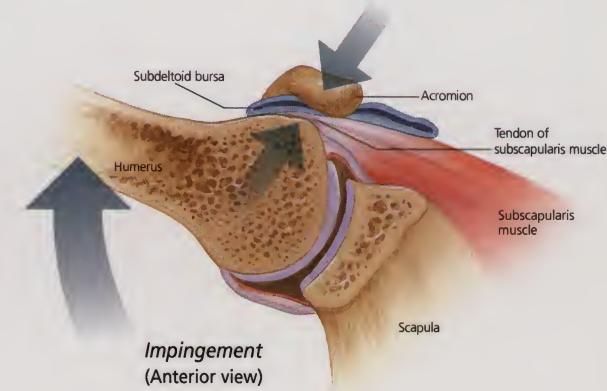
Acromioclavicular dislocation
Grade III (Anterior view)



Rotator cuff tear
(Anterior view)



Impingement
(Anterior view)





Understanding the Foot & Ankle

Ankle –
(Hinge joint)

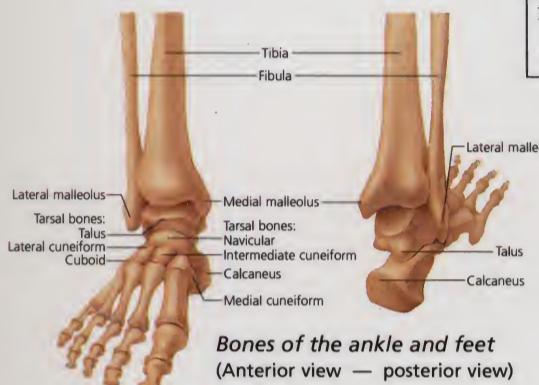


The foot and ankle

The foot and ankle form a complex structure that includes 33 joints, 26 bones and more than 100 muscles, tendons, and ligaments. The foot and ankles work together to provide the body with support, balance, and mobility.

Structurally, the foot is divided into three sections. The **forefoot** plays a major role in weight bearing and balance and contains the long bones of the foot (**metatarsals**) and the toes (**phalanges**), which are connected at the ball of the foot by five metatarsal phalangeal joints. The **midfoot** contains five interlocking **tarsal bones** (cuboid, navicular, and cuneiform) that form the arch of the foot. It is connected to the forefoot and hindfoot by muscles and the **plantar fascia ligament**, an important structure that stabilizes the foot and helps maintains the arch. Two additional tarsal bones make up the **hindfoot**. The **calcaneus** (heel) is the largest, strongest bone in the foot and the site of attachment for the powerful **Achilles tendon**. The **talus** (astragalus) sits above the calcaneus and between the lower ends of the leg bones (**tibia** and **fibula**) to form the ankle joint. The talus is involved in multiple planes of movement and is responsible for transferring weight and pressure from the leg to the foot.

The ankle joint itself is a uniaxial, hinge-type joint capable of both upwards (**dorsiflexion**) and downwards (**plantarflexion**) motion. Limited rotation, abduction and adduction is also possible. The ankle joint is protected by a fibrous capsule and supported on each side by strong collateral ligaments.



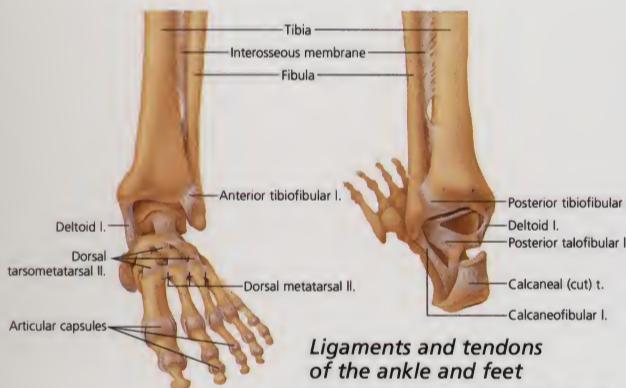
Key of Abbreviations

b. Bone	I. Ligament
II. Ligaments	t. Tendon

Bones of the ankle and feet
(Anterior view — posterior view)



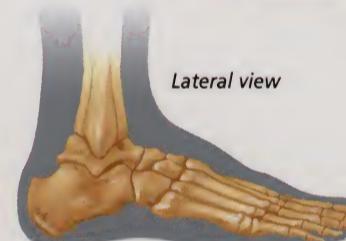
Foot bones –
(Glide joints)



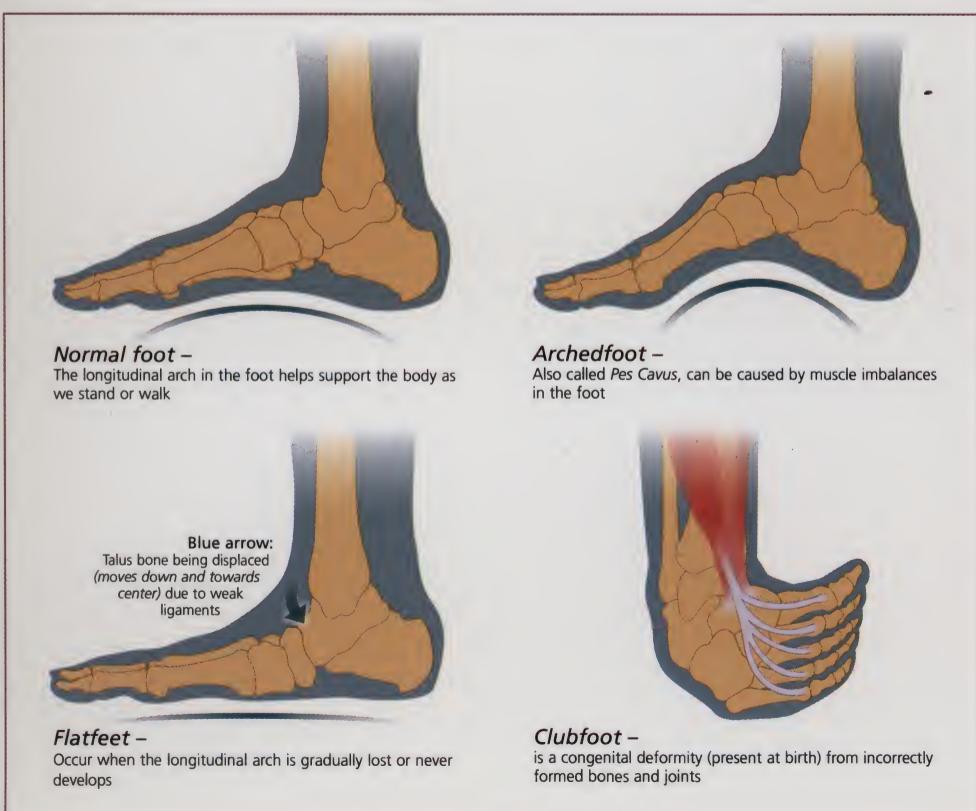
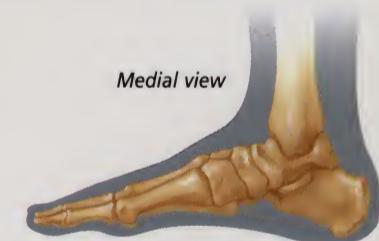
Ligaments and tendons
of the ankle and feet
(Anterior view — posterior view)



Foot and Ankle
(Anterior view)



Medial view



Normal foot –

The longitudinal arch in the foot helps support the body as we stand or walk.

Blue arrow:
Talus bone being displaced
(moves down and towards center)
due to weak ligaments

Flatfeet –

Occur when the longitudinal arch is gradually lost or never develops.

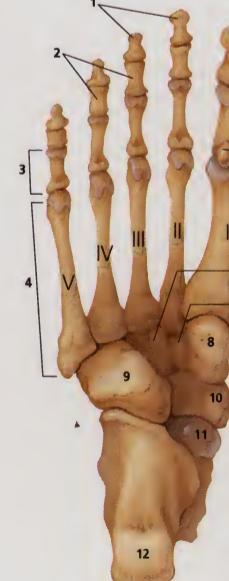
Arched foot –

Also called **Pes Cavus**, can be caused by muscle imbalances in the foot.

Clubfoot –

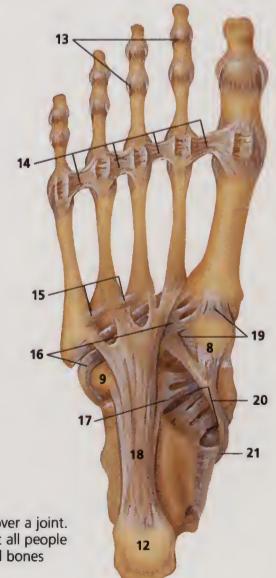
is a congenital deformity (present at birth) from incorrectly formed bones and joints.

Bones and Ligaments of the Right Foot
(Plantar View)



- 1 Distal phalanges
- 2 Middle phalanges
- 3 Proximal phalanges
- 4 Metatarsal bones I to V
- 5 Sesamoid bones*
- 6 Lateral cuneiform b.
- 7 Intermediate cuneiform b.
- 8 Medial cuneiform b.
- 9 Cuboid b.
- 10 Navicular b.
- 11 Talus
- 12 Calcaneus
- 13 Articular capsules
- 14 Deep transverse metatarsal II.
- 15 Plantar metatarsal II.
- 16 Fibularis longus t.
- 17 Plantar calcaneocuboid (short plantar) I.
- 18 Long plantar I.
- 19 Plantar tarsometatarsal II.
- 20 Plantar calcaneonavicular (spring) I.
- 21 Tibial posterior t.

*A **sesamoid bone** is a bone that forms in a tendon over a joint. The patellae (kneecaps) are large sesamoid bones that all people have. Most people have extra, much smaller sesamoid bones near other joints, often in the hands and feet.





Understanding the Hand & Wrist

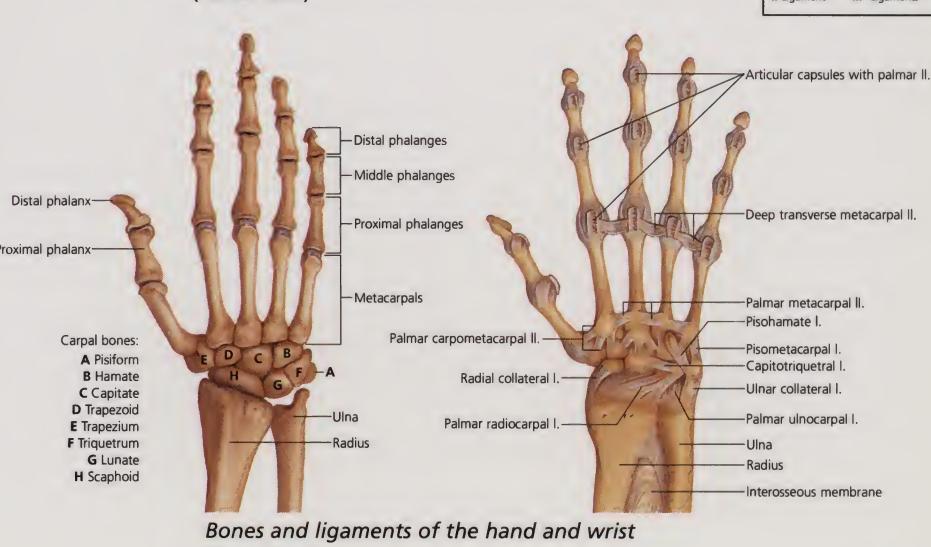
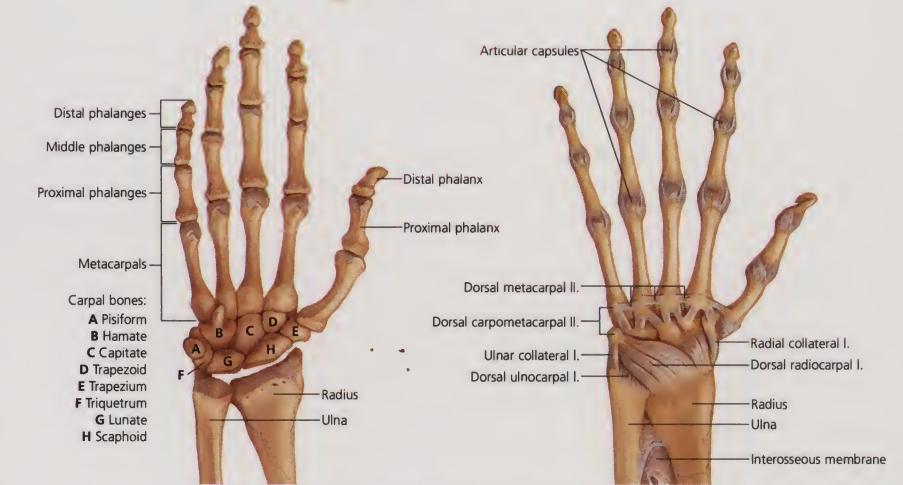
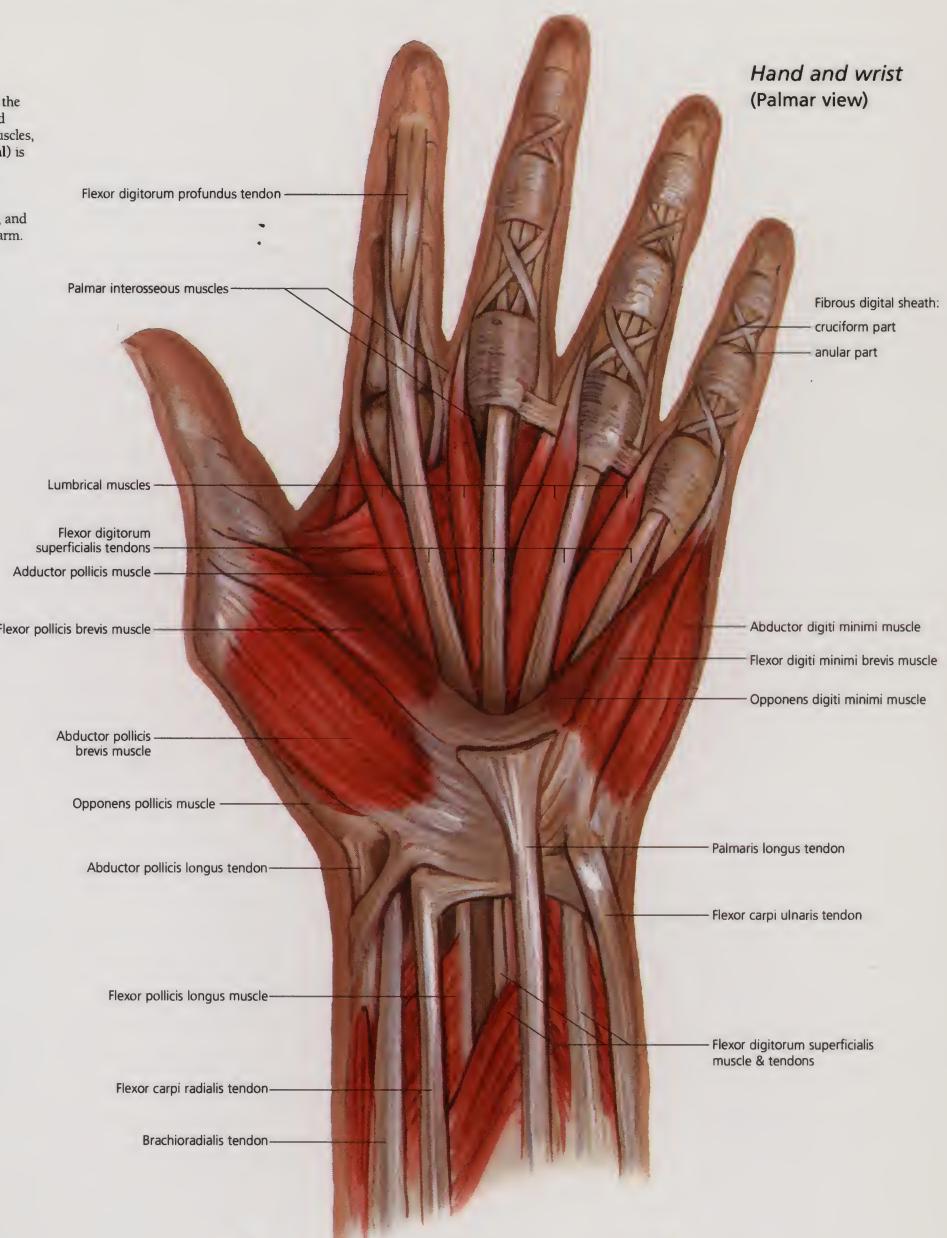
Anatomy of the hand and wrist

The hand and wrist together form a complex structure composed of 27 small bones connected by joints, muscles and tendons. The framework of the hand is shaped by five large **metacarpal** bones that articulate with the fingers and wrist. The fingers each contain three smaller jointed bones called **phalanges**; the thumb has two phalanges. The hand's wide range of fine movements is made possible by numerous small joints, long and short muscles, and extensor and flexor tendons that allow the fingers and thumb to straighten, bend, and flex. The highly flexible thumb joint (carpometacarpal) is positioned at a 90-degree angle to the finger joints, giving the hand the unique ability to grasp, pinch, and manipulate objects. Tendon sheaths surrounding the tendons contain **synovial fluid** for smooth movement of the hand and wrist.

The **wrist** connects the hand to the **ulna** and **radius** of the arm. It consists of eight **carpal** bones with multiple joints that allow flexion, extension, and rotary movements. A distinctive feature of the wrist is the **carpal tunnel channel** through which the tendons from the hand pass to reach the forearm.



Hand and wrist (Palmar view)

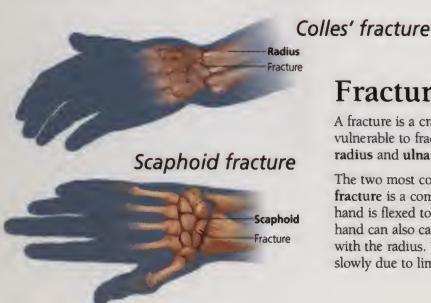


Carpal tunnel syndrome

Carpal tunnel syndrome is an inflammatory condition affecting the median nerve and flexor tendons that pass through the **carpal tunnel**. This archway is formed by the carpal bones and sits beneath the broad **transverse ligament** extending across the palm. Inflammation and thickening of the tendons within the tunnel and the ligament above it may be caused by many factors (see below). Swelling in the tunnel compresses the median nerve, restricting blood flow and oxygen supply and causing tingling, numbness, weakness, and pain in the **wrist**, **hand**, **fingers** and **thumb**. Carpal tunnel syndrome can usually be reversed if treated early. Chronic inflammation may lead to permanent nerve damage.

Possible causes of carpal tunnel syndrome include:

- Repetitive stress injuries (overuse syndrome)
- Underlying medical conditions including arthritis, diabetes, and obesity
- Pregnancy
- Bone dislocations and fractures



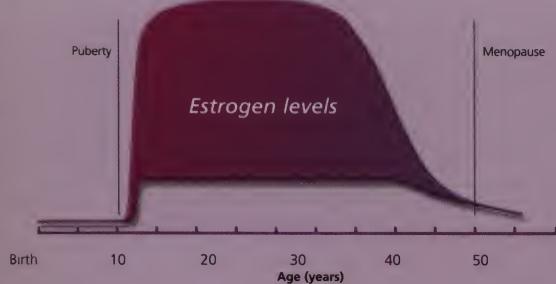
Fractures

A fracture is a crack or break in a bone. There are multiple bones in the hand and wrist vulnerable to fracture, including the **carpal bones** located at the base of the hand and the **radius** and **ulna**, where they connect to the wrist.

The two most common types of fracture are Colles' and scaphoid fractures. A **Colles' fracture** is a complete transverse break in the end of the radius, and often occurs when the hand is flexed to stop a fall. It is a common injury in older people. A fall on the palm of the hand can also cause a **scaphoid fracture**, a break in the scaphoid carpal bone that articulates with the radius. This injury may initially be confused with a bad sprain and tends to heal slowly due to limited blood supply.



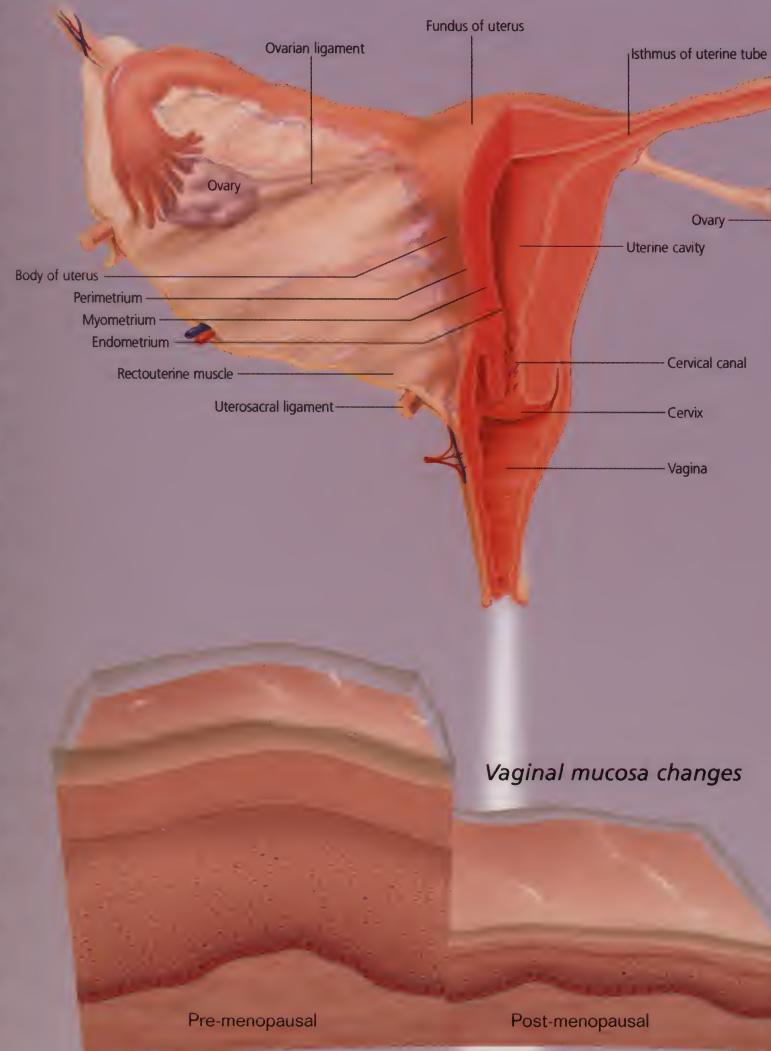
Understanding Menopause



The role of estrogen

As menopause approaches, levels of the female sex hormone **estrogen** gradually decline. There are several different estrogens, including the most potent form, estradiol. Estrogens and female sex cells (the *ova* or eggs) are produced in the ovaries from the onset of puberty through menopause. Estrogens are responsible for the development and maintenance of **female characteristics** and **sexual reproduction**. They also play important roles in other parts of the body:

- **Genital tract** Stimulate a favorable environment for the survival of sperm during the menstrual cycle
- **Breasts** Stimulate the growth of non-glandular breast tissue
- **Heart** Improve circulation and prevent high blood pressure
- **Skeleton** Help retain calcium in the bones



Vagina, Uterus, Fallopian Tubes, Ovaries
Coronal Section

How does the body change during menopause?

One of the predominant changes that occurs with menopause is the gradual thinning and drying (*atrophy*) of tissue in the genitourinary tract, including the vagina, vulva and urethra. Other physiological changes triggered by decreased estrogen include:

- **Reproductive system** Organs decrease in size; production of eggs and hormones stops
- **Breasts** Loss of firmness; change in size/shape
- **Pelvis** Supporting ligaments may weaken and cause urinary incontinence
- **Skin & hair** Often become thinner and drier; skin may lose some natural elasticity and be more prone to UV damage
- **Musculoskeletal** Loss of bone density which can lead to osteoporosis
- **Blood cholesterol** Levels of LDL cholesterol rise as estrogen levels decline

Emotional and cognitive effects of menopause

Changing hormonal levels can trigger changes in mood and cognitive function. These symptoms can occur briefly or for longer durations, sometimes over several years.

- **Anxiety or panic attacks**
- **Mood swings and irritability**
- **Short-term memory problems**
- **Depression**
- **Difficulty concentrating**
- **Decreased sex drive**

What is menopause?

It is a gradual process that occurs as a woman's ovaries produce decreasing amounts of estrogen until menstruation and ovulation finally cease. It normally occurs between the ages of approximately 40 and 55. Menopause may also result from surgical removal of the ovaries.

Menopause can be divided into three stages:

Perimenopause – A period of several years during which estrogen and progesterone levels steadily decline. Symptoms may include changes in the menstrual cycle (length and flow); intermittent ovulation; missed periods; hot flashes; and emotional/cognitive changes.

Menopause – Menopause occurs when ovarian hormone production is too low to initiate a menstrual cycle and periods stop completely.

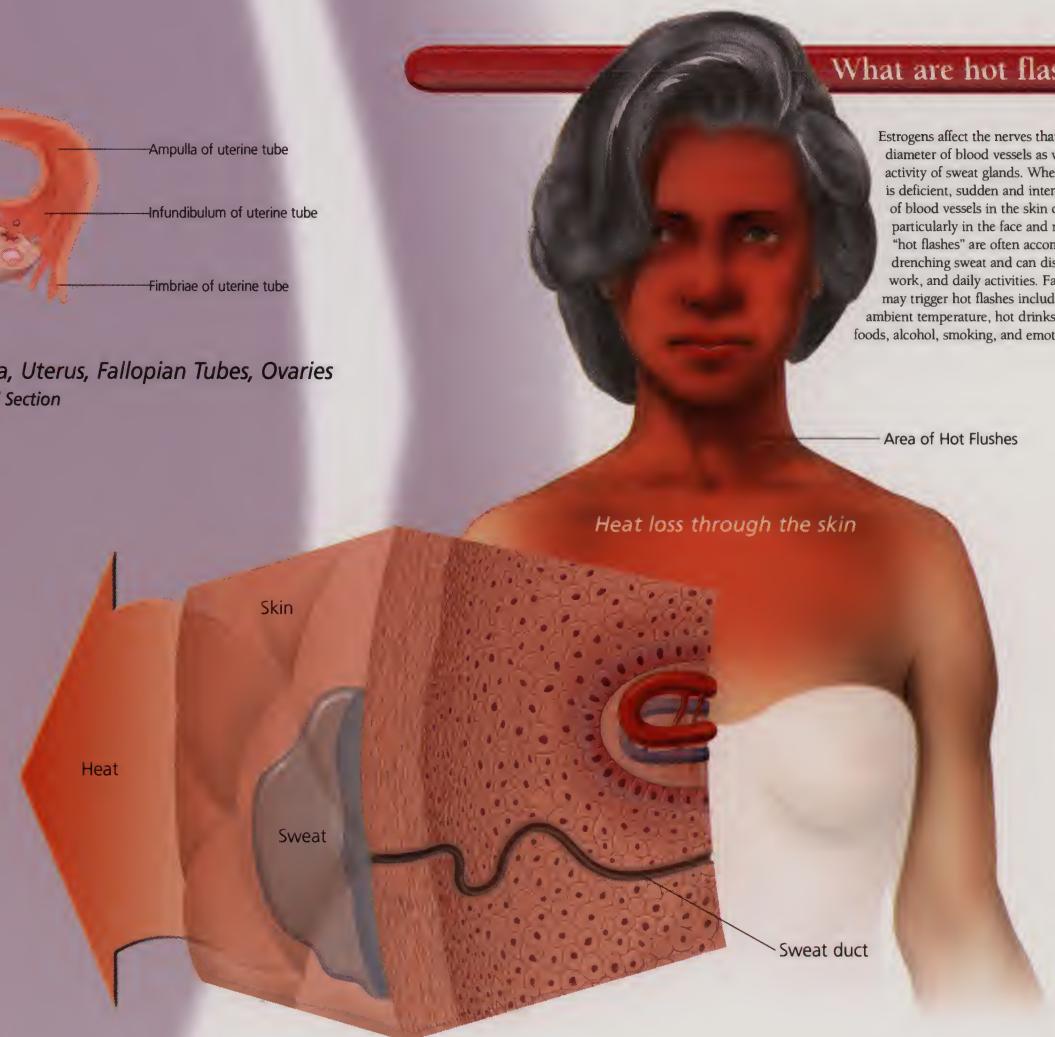
Postmenopause – Also known as true menopause, this phase is usually defined as 12 full months without a menstrual period. All estrogen production in the ovaries has ceased.

What are hot flashes?

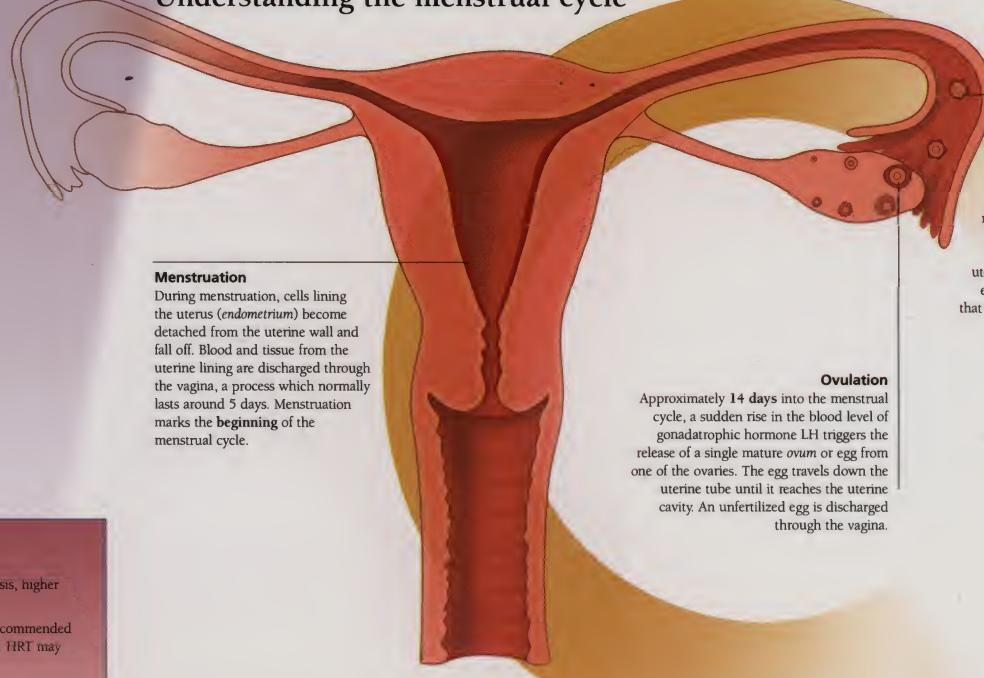
Estrogens affect the nerves that control the diameter of blood vessels as well as the activity of sweat glands. When estrogen is deficient, sudden and intense dilation of blood vessels in the skin can occur, particularly in the face and neck. Such "hot flashes" are often accompanied by drenching sweat and can disrupt sleep, work, and daily activities. Factors that may trigger hot flashes include high ambient temperature, hot drinks, spicy foods, alcohol, smoking, and emotional stress.

Area of Hot Flushes

Heat loss through the skin



Understanding the menstrual cycle



Treating menopause symptoms and risks

There are a variety of treatments available today for reducing menopause symptoms and addressing potential risks such as osteoporosis, higher cholesterol, and heart disease. Decisions are highly individualized and should be made only after discussion with a physician.

HRT - Menopausal symptoms often require no treatment. If side effects are severe, HRT (hormone replacement therapy) may be recommended to reduce the intensity and incidence of hot flashes, alleviate insomnia, and decrease vaginal dryness and drying/thinning of the skin. HRT may also decrease the risks of postmenopausal heart disease and osteoporosis.

Non-prescription alternatives – Other approaches to both the symptoms and longer-term effects of menopause can include increased exercise, stress reduction programs, and a nutritionally balanced diet that includes foods rich in **calcium** and **phytoestrogens**, such as **soy**.

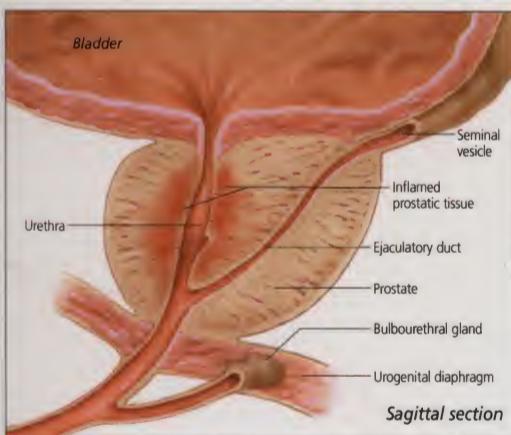
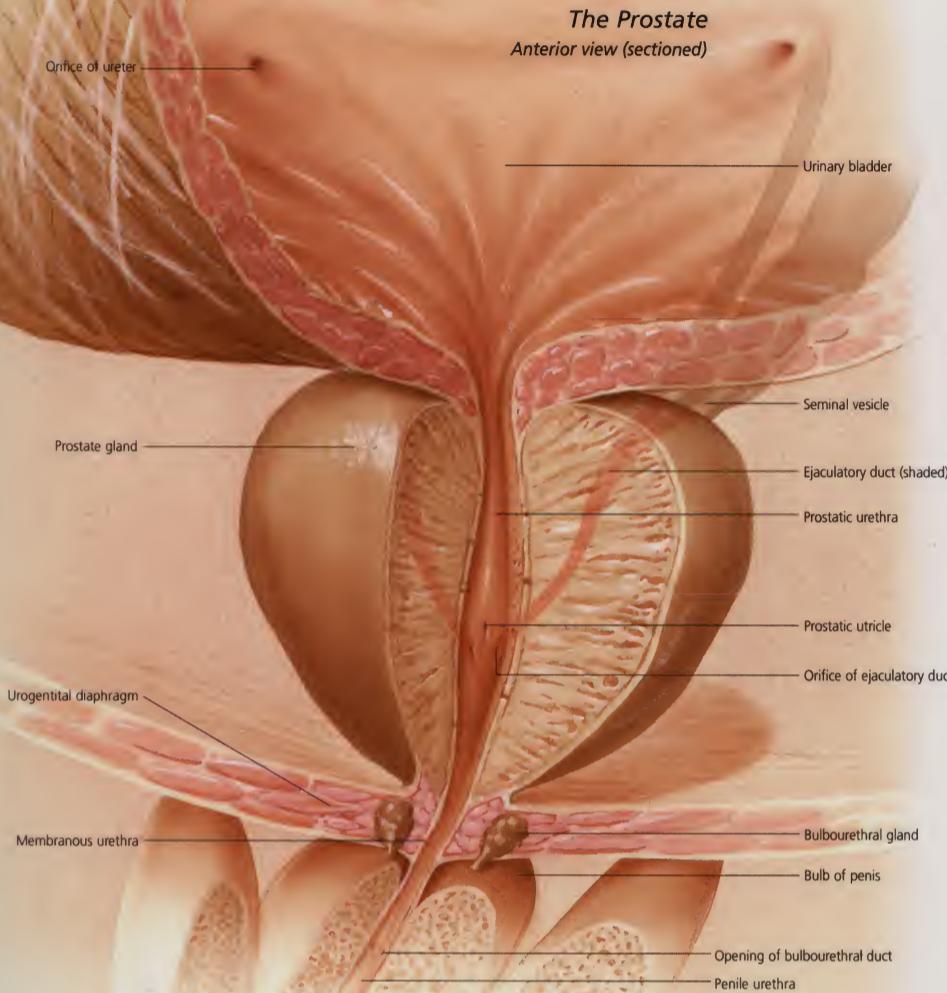
New therapies – New therapies such as SERMs (selective estrogen receptor modulators) are also available for the treatment of menopausal symptom. SERMs inhibit the effects of estrogen on certain tissues while mimicking beneficial estrogen action in other parts of the body, including bone tissue and blood cholesterol.

The menstrual cycle refers to the sequence of events that occurs in the **endometrium**, the cell layers lining the uterus. This cycle normally lasts for approximately 28 days. Its purpose is to prepare the uterus for possible pregnancy. The menstrual cycle is governed by the **endocrine system**.

During the first two weeks, the pituitary gland releases follicular stimulating hormone (FSH) to stimulate egg growth in the ovary. Ripening eggs produce estrogen, causing thickening of the uterine lining. About 14 days into the cycle, levels of luteinizing hormone (LH) increase, triggering the release of a ripened egg (follicle). If fertilization does not occur, decreasing estrogen and progesterone levels initiate menstruation and the cycle begins again.



Understanding the Prostate



What is benign prostatic hyperplasia (BPH)?

BPH, also known as **enlarged prostate**, is a noncancerous growth of tissue within the transition zone that can restrict urination and cause other urinary problems. It is a common condition in men over 60 years of age. BPH is **not associated with prostate cancer** and can be effectively treated. About one-third of all men with BPH will eventually require treatment for their symptoms.

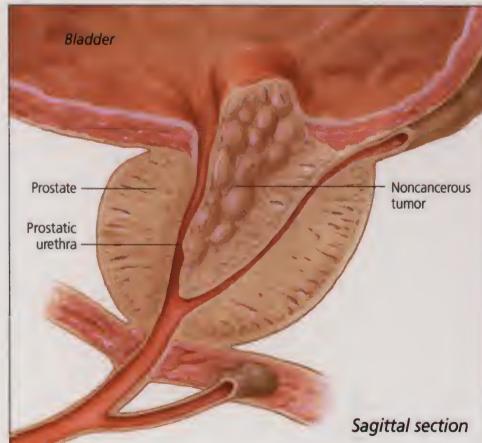
BPH symptoms and treatment

BPH symptoms include a **weak urine stream**, a sensation of **incomplete emptying of the bladder**, **urinary frequency** and **urgency**, and the need to urinate **several times during the night**.

Diagnosis of BPH is based on factors including medical history, a physical exam, and a symptom score assessment. Blood tests, urinalysis, X-rays, cystoscopy, ultrasound and other tests may be used to confirm the diagnosis and guide treatment decisions.

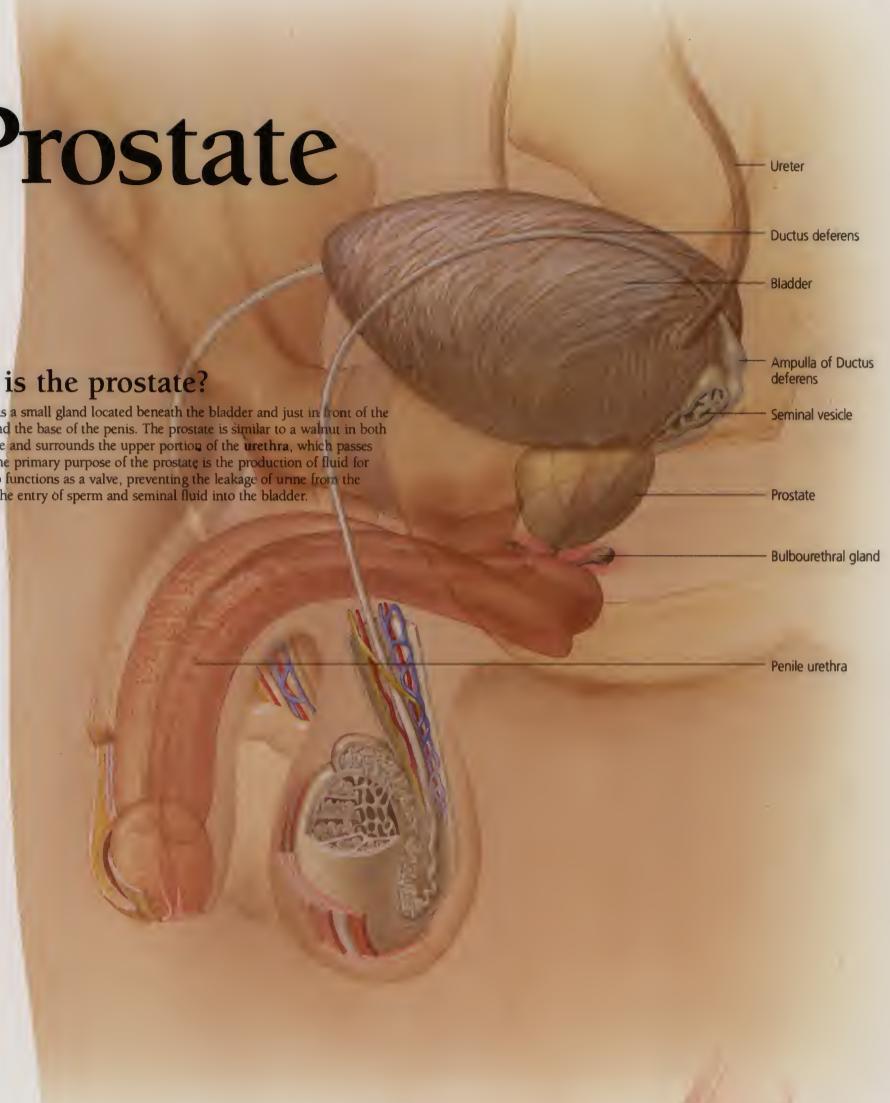
Treatment options include:

- **Watchful waiting** — if symptoms are manageable
- **Medication therapy** — to relax the prostate muscles, shrink prostate tissue, or both
- **Minimally invasive therapies** — such as microwave thermotherapy heat targeted areas of prostate tissue to relieve symptoms
- **TURP** — or transurethral resection of the prostate involves the surgical removal of the inner portion of the prostate
- **Phytotherapeutics** — saw palmetto and other plant-based therapies may be effective in treating BPH but are not FDA approved



What is the prostate?

The prostate is a small gland located beneath the bladder and just in front of the rectum, behind the base of the penis. The prostate is similar to a walnut in both shape and size and surrounds the upper portion of the **urethra**, which passes through it. The primary purpose of the prostate is the production of fluid for semen. It also functions as a valve, preventing the leakage of urine from the bladder and the entry of sperm and seminal fluid into the bladder.



Prostate — zones

Sagittal section



Zones of the prostate

There are three primary zones within the prostate. The outermost section is called the **peripheral zone**. It makes up approximately 70% of the prostate gland's total volume and is the area where prostate cancer is most likely to develop. The innermost section of the prostate is the **transition zone**, a small area that surrounds the urethra. In **benign prostatic hyperplasia** (BPH) (see below), noncancerous growth of tissue (hyperplasia) in the transition zone causes constriction of the urethra and restricts urinary flow. Between these two zones is the **central zone** of the prostate, through which the ejaculatory ducts pass.

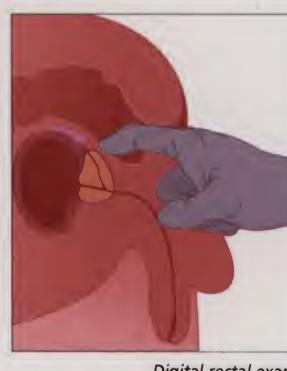
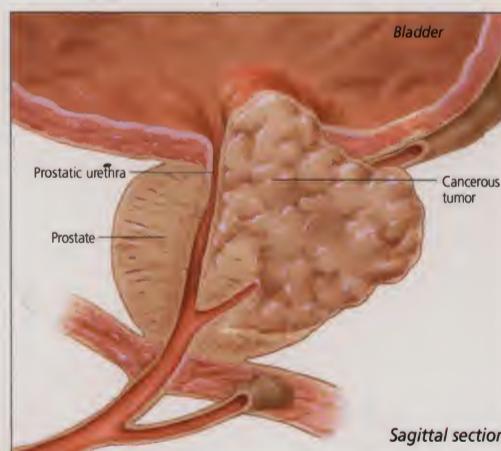
Detection and treatment of prostate cancer

Recent improvements in detection methods are now allowing earlier diagnosis and treatment of prostate cancer. This has produced a significant decline in mortality rates in recent years.

Symptoms

Although early stages of prostate cancer often go unnoticed, a variety of symptoms may occur as the disease progresses. Many of these symptoms are also associated with benign prostatic hyperplasia (BPH), a noncancerous condition.

- Frequent urination, particularly at night
- Inability to urinate or difficulty starting urination
- Pain or burning during urination
- Presence of blood in urine or semen
- Difficulty achieving an erection
- Pain during ejaculation
- Chronic pain or stiffness in the lower back or legs



Detection

The most reliable detection of early prostate cancer involves a combination of two tests:

- **Digital rectal exam** — a physical examination of the prostate via the rectum. It detects hardness, bumps, or swelling caused by cancer or other prostate problems. While this test is important, it often cannot detect prostate cancer until it is more advanced.
- **Prostate specific antigen (PSA)** — a blood test that measures an enzyme produced by the prostate. An elevated PSA is considered the best predictor of prostate cancer and can detect the presence of disease up to 6 years earlier than a digital rectal exam. If either test indicates a possibility of cancer, additional tests may be performed to confirm the diagnosis.
- **Transrectal ultrasonography** — to measure prostate size and locate possible sites of cancer cells for needle biopsy.
- **Needle biopsy** — tissue samples are taken from several areas of the prostate for microscopic diagnosis.

Treatment

The type of treatment recommended varies from patient to patient. A classification method called the **Gleason score** is often used to rank malignancy and determine the most appropriate treatment.

- **Watchful waiting** — recommended for some men with early, slow growing prostate cancer or other serious medical problems.
- **Surgery** — options for more advanced disease include radical prostatectomy (removal of the entire prostate gland) and nerve-sparing surgery, a newer surgical technique.
- **Radiation** — external beam radiation therapy offers a highly effective alternative to surgery in many prostate cancer patients.
- **Brachytherapy** — radioactive seeds are implanted in the prostate to eradicate cancer cells.
- **Hormone therapy** — generally recommended when prostate cancer has spread to other tissues. Hormones linked to the growth of cancer cells are inhibited through surgical or drug therapy.

Went from CEO to Chairman of the Net.

No patience for another NSAID-related ulcer.

Today, people who have a history of NSAID*-related gastric ulcers can continue their NSAID use while enjoying retirement. However, continued use of NSAIDs such as aspirin and others may cause a gastric ulcer. If this happens, PREVACID can heal the gastric ulcer. Plus, starting this patient earlier on PREVACID could actually reduce the risk of recurrence in the first place. It's just one more way PREVACID can help you meet the unique needs of your patients.

For more information on gastric protection,[†] talk to your PREVACID sales rep.



Uniquely patient driven.

Important Safety and Other Information

[†]Gastric protection is defined as reducing the risk of gastric ulcer recurrence in patients continuing NSAID use.

- Controlled studies for healing were conducted up to 8 weeks and for risk reduction up to 12 weeks.
- The most frequently reported adverse events with PREVACID in adults were diarrhea (3.8%), abdominal pain (2.1%), and nausea (1.3%).
- In the risk reduction study of PREVACID for NSAID-associated ulcers, the incidence of diarrhea was 5% and 3% for the PREVACID and placebo groups, respectively.
- Symptomatic response to therapy does not preclude the presence of gastric malignancy. PREVACID formulations are contraindicated in patients with known hypersensitivity to any component of the formulation.

For further information, please see the accompanying complete prescribing information for PREVACID.



PREVACID SOLUTION:
gastric protection[†]

This illustrated portfolio is brought to you by PREVACID.

Please refer to page 9 for important safety and other information.

